4/6
3 oc e

THE STANDARD PHYSICIAN

VOLUME I

James Crichton Browne

THE STANDARD PHYSICIAN

A New and Practical Encyclopaedia of Medicine and Hygiene Especially Prepared for the Household

EDITED BY

SIR JAMES CRICHTON-BROWNE, M.D., LL.D., F.R.S.

LORD CHANCELLOR'S VISITOR IN LUNACY, LONDON

SIR WILLIAM H. BROADBENT, Bart., K.C.V.O., M.D., F.R.S.

LATE PHYSICIAN-IN-ORDINARY TO THE KING AND PRINCE OF WALES

ALFRED T. SCHOFIELD, M.D., M.R.C.S.E.

VICE-PRESIDENT BRITISH COLLEGE OF PHYSICAL EDUCATION
VICE-PRESIDENT NATIONAL HEALTH SOCIETY
HON. PHYSICIAN FRIEDENHEIM HOSPITAL, LONDON

PROFESSOR KARL REISSIG, M.D., Etc.

HAMBURG, GERMANY

AND

SMITH ELY JELLIFFE, A.M., M.D., Ph.D.

COLUMBIA UNIVERSITY, NEW YORK, U.S.A.

With the Assistance of MANY LEADING SPECIALISTS in the Treatment of Diseases and Experts in Medicine and Surgery

THE EDUCATIONAL BOOK CO., LIMITED.

LONDON

1908

EDITORIAL PREFACE

THE general utility of this work, THE STANDARD PHYSICIAN, and the value of the guidance it affords, within a well-defined area, in plain and clear language, can scarcely be over-estimated. Some time ago, the late Lord Derby, with great perspicacity, called attention to three lines of defence against disease—the public, the professional, and the private—and declared that, from every point of view, the last of these is, and must always be, the most salient and important.

The first line of defence indicated by Lord Derby has been vastly strengthened of late years. Central and Local Sanitary Authorities have come into existence; specially qualified Medical Officers of Health have been appointed in almost every district of the country; legislation more or less judicious, directed against several conditions productive of disease, has been undertaken on the large scale, and Governments have begun to show an intelligent appreciation of hygiene as the basis of good citizenship.

Lord Derby's second line of defence, the professional one, has also been fortified, for medical men are now better educated and equipped than they have ever been before, and are as eager as ever, with unselfish devotion, to diminish the prevalence of these states of ill-health on which their living depends.

But it is in Lord Derby's third line of defence—the private one, which ought to be the strongest—that weakness is still manifested, and in connection with which the need of support and reconstruction is urgent. The enormous sale of empirical remedies, and their indiscriminate employment, the success that attends a host of impudent charlatans, the vogue of every novel and fashionable healing craze, and the organised endeavours to cheapen medical advice, all betoken a dense and widespread ignorance of the very elements of medical science, and the ascendency of the mischievous credulity to which that ignorance gives rise. Innumerable lives are being sacrificed to the Moloch of quackery, countless constitutions are

being irreparably damaged and crippled by loudly vaunted and costly but futile specifics, and by cures that are no cures: and untold suffering and misery are caused by the neglect of simple sanitary precautions and by the postponement of medical treatment until the period when it might have been efficacious has passed.

The corrective for all this is the diffusion of sound medical knowledge in words easy to be understood of the people. The teaching of hygiene and temperance, and of the rudiments of anatomy and physiology in schools, will lay a good foundation. Health visitors and leaflets and lectures will keep interest in these questions alive, and it is hoped that these volumes will supply a standard by which to test current medical theories and nostrums, and give trustworthy information in emergencies, and practical indications in these simple ailments, in which the assistance of the doctor is unnecessary, as well as directions for first aid in graver maladies, at their outset, before the doctor's assistance is available.

It is ignorance and self-sufficiency that are the bane of medical science and practice, and by helping to dispel these THE STANDARD PHYSICIAN must conduce to a timely resort to skilled medical advice. It teaches that medical science is not a mysterious cult and happy hunting ground for the unscrupulous pretender, but is founded on physiological principles that are intelligible to all, and that medical practice cannot be conducted by rule-of-thumb, but only in accordance with a system of knowledge, acquired by careful training and prolonged experience, and applied by judgment, insight, and technical skill, and under a sense of responsibility. It will discourage the rash and presumptuous amateur by giving prominence to the proper limits of domestic medication, beyond which lies danger, and it will awaken to a juster recognition of the part the medical man should play both in remedial and prophylactic medicine. It will convince those who study it that the family physician, not in book form, but in the flesh, should be not merely the medicine-man in sickness, but at all times the medical officer of health and privy councillor of the household. A clear and rational comprehension of the nature of disease and of its antecedents, and of the preliminary measures by which its inroads may be resisted, must impart alike confidence and caution. Reference to this work, which is simple and intelligible in style, will in large degree prevent the misapprehensions that now frequently arise

from the practice of consulting text-books and dictionaries, written for the medical profession and abounding in technical terms and pathological allusions.

The amount of information contained in this work is certainly remarkable and, we believe, unique, and it is only the appeal the work makes to the reading public in the great countries of the world that has made practicable the presentation in such a form of so rich a store of useful knowledge.

Some, indeed, may cavil at the simplicity of the advice it gives, in the language of Pope's much-abused line—

"A little learning is a dangerous thing."

But, we venture to say, a little knowledge is *not* a dangerous thing, provided it be accurate as far as it goes, and that in the science of health especially is the line untrue, for its facts and principles are so simple compared with those of medicine that they can readily be acquired and understood by the untrained lay mind. To us, therefore, the simplicity and directness of the advice is its greatest claim, and we can cordially recommend this work as a very efficient help in time of need.

We should like, in conclusion, to point out a few of the more noteworthy features of this book.

So far as we are aware, this is the first work of this character which contains a manikin, such as is now in use for instructional purposes in German schools. This alone is a feature of much interest, and we know nothing that so well takes the place of the anatomical investigation of the body itself.

The illustrations of this book are another valuable feature, and bring its teachings better home to the mind than columns of description could do.

Lastly, there is throughout the book a full description of what may be called "natural therapeutics" or hygienic measures and precautions. These, in their great variety, are mainly of modern origin; but this work gives a clear and intelligible account of them, including all recent improvements. This is the more valuable as the larger part of domestic medicine consists in the application of these natural therapeutics, rather than in drugs, which are best left to the physician.

Finally, one word of caution. Every valuable medicine we possess

is or may be a poison—that is to say, it consists of a drug which, wrongly used, may prove injurious or even lethal, but rightly used can heal. So is it with such a work as this. Certain unbalanced minds may so misuse it as to miss its real teaching, and thus, instead of being a harbinger of health, it may be made to minister to diseased fancies.

Some people think that a knowledge of hygiene and elementary remedies leads to morbid introspection, but such is not found to be the case. On the contrary, those who are least liable to this are the doctors themselves, who, though incessantly occupied in reading and practising medicine and in dealing with disease, are singularly free from hypochondria themselves.

In the same way the bulk of readers require no caution at all; and to the minority we say, use the counsels and knowledge here given, but do not abuse them. Let them give you that calmness and courage in the hour of need that true knowledge confers, but do not let them be the absorbing centre of your leisure thoughts.

Remember, the pursuit of health *as an object* defeats itself. Let the object in life be outside yourself or your own welfare, and of a higher and nobler character, and let this work be used to preserve health, as the means to a worthy end, and not as an end in itself.

We feel quite sure that none can study this work aright without having placed in their hands a knowledge that can enable them to check some needless sickness or to avert some premature death.

ALFRED T. SCHOFIELD,

JAMES CRICHTON-BROWNE,

WILLIAM H. BROADBENT.

CONTENTS

(NOTE.—*To facilitate reference, it should be borne in mind that volume I comprises pages* 1–380 *; volume II, pages* 381–764 *; and volume III, pages* 765–1152.)

GENERAL REMARKS ON DISEASE

DIAGNOSIS AND TREATMENT OF DISEASE

PATHOLOGY—HYGIENE—MATERIA MEDICA

(For complete list of topics treated in this part of the work, see the index.)

ILLUSTRATIONS

COLOURED AND FULL-PAGE PLATES

Volume I

Volume II

Volume III

TEXT ILLUSTRATIONS

(NOTE.—*Volume I comprises pages 1–380; volume II, pages 381–764; and volume III, pages 765–1152. The reader should bear this in mind when wishing to consult an illustration.*)

GENERAL PREFACE

IN presenting to the British public this work on household medicine, the Editors feel that they are supplying a need which in some quarters has been long felt, and in others is none the less actual because unappreciated—the need of some work of reference on medicine and hygiene which shall speak with the conservative authority of a responsible physician, and at the same time be couched in language which the intelligent layman can understand. Hitherto those who have felt the need of such a book have looked for it in vain, and others less discriminating have turned for guidance to various volumes issued for thinly veiled commercial purposes, which usually contain instructions of uncertain value. The mistaken theories gathered from such books, and adhered to with the stubbornness of imperfect comprehension, have been one of the irritating obstacles which obstruct the work of the physician, and have led to a general condemnation on the part of the profession of all "doctor books" in the hands of the layman. Yet none would recognise more readily than the physician the advantage of finding in the patient and his friends a sane and sensible comprehension of the structure and functions of the human body, of the influences which commonly affect them in health and disease, and of the results which may reasonably be expected from therapeutic measures.

Such comprehension will enable the patients and their friends to second more efficiently the efforts of the physician, to appreciate more fully the successes which he achieves, and to judge more justly those cases in which his efforts are unavailing. They will cease to expect miracles from him, and, on the other hand, will not belittle his motives and attainments, as many are too prone to do. The result of this better understanding will be not only gratifying to the physician but inestimably advantageous to the patient.

It is believed that an intelligent use of these volumes will do much to bring about just such an understanding. To this end it has been arranged

with a careful and scientific, although popular, treatise on anatomy and physiology, illustrated by a Manikin which shows the relative positions of the organs and systems. In the second portion of the work are presented the signs and symptoms of most of the ills common to man, and general rules for treatment are given. The keynote of modern medicine is prevention; and special stress has, therefore, been laid on those facts which, if more widely disseminated among all classes, would result in a great lessening of many of the diseases now so prevalent. No work of modern times, meant for popular use, has dwelt as strongly on the preventive features that are of so much importance; and the Editors, each working in his respective field, have endeavoured to set forth a correct statement of the "ounces of prevention" that are worth so many pounds of cure.

In this second part, further, may be found clear and sensible descriptions of disease-processes, from which the reader may really find out what is ailing him if he be sick. The best general road to recovery lies in the recognition of the illness: not in the cheap and meaningless directions to take some of this medicine or some of that, but in the essential truths of hygiene and right living. The giving of medicines, if they are worth anything, is a serious matter; and hence there is little drugging in these pages. The actions of remedies, however, are described as briefly as is consistent with the accepted facts of materia medica; and the indications for dosage are laid down in conservative terms. Throughout the work great care has been taken to exclude anything which, by those prone to reckless self-medication, could be interpreted as an encouragement in that direction, and it seems reasonable to expect that the patent-medicine evil will be materially reduced by the realisation of the limitations of drug-action which is fostered by THE STANDARD PHYSICIAN.

Special attention is called to the article on PAIN, where, by means of charts, the chief pain-producing diseases are accurately located. A careful study of this article, with its excellent illustrations, will prove of great service in locating and diagnosing an illness. Such study will also convince one how difficult it may be to determine the existing disorder, and how essential it becomes for the physician to learn from his patient the exact region and character of his pains. Close observation by one who has read this chapter will prove of immense value to both physician and patient when they meet

professionally—to the physician in that it renders his diagnosis more certain and thus saves useless medication; to the patient in that he is spared unnecessary drugging, and in that no time or money is wasted in the process of "finding out what is the matter."

Special articles of merit are largely to be credited to particular members of the staff, one of whom has unfortunately been taken from us by the recent lamented death of Sir William Broadbent.

THE PUBLISHERS

THE PHYSICIAN

In case of sickness there is nothing that will impart such a sense of comfort and confidence, even in moments of great anxiety, to both the patient and his family, as the presence of a physician in whom they place confidence, who makes them feel instinctively that, come what may, everything will be done for the patient that trained intelligence and sympathetic skill can dictate. On the other hand, the realisation that he is the object of such confidence enables the physician to do his part more effectively, to put forth his best efforts against the disease that he is striving to combat.

Unfortunately such ideal relations between the physician and those who employ him are not always realised. There is no class of persons more frequently the subject of mistaken estimate than physicians. Some are prone to regard them as possessed of superhuman powers, and consequently demand miracles of them ; while others adopt a suspicious and guarded attitude, under the idea that a doctor thinks of nothing but his fees and that most of the special knowledge which he claims is empty pretence. Both these mistaken estimates are disastrous to the physician, since he who is looked upon as a magician may eventually be misled to attempt the impossible ; and even the man who is truly devoted to his science may ultimately lose his ideals if always regarded as a charlatan.

Neither of these mistakes on the part of the public is justifiable. Physicians are human, and subject to the same variations of character and intelligence as other persons. But it is fair to assume that most persons who study medicine have an aptitude for practising it. One is not likely to adopt so arduous a profession unless he is urged by a genuine preference for it.

The qualities most desired in a physician are honesty and a strict sense of duty. The man who possesses these qualities will be as good a physician as his talents will permit, and will do for his patients all that lies in his power. There are few physicians who are not anxious to do for their patients all they possibly can, and results are limited by their power and not by their willingness.

But, serious as are the physician's responsibilities toward his patients, there are equally important duties of the patient toward the physician. One of these is concerned with the financial aspect of the matter. It is a fact often noted that "the doctor is the last man paid." In many instances those who employ him are all too prompt to take advantage of the ethics of his profession which forbid him to refuse his aid to those in need of it ;

and the bad debts on the doctor's account-book invariably include not only those who cannot pay, but many who do not wish to pay. There are very few doctors who would refuse help if consulted by persons without means. Probably no other class of men give so freely and generously of the time and skill and knowledge which are as truly their stock-in-trade as are the goods of the merchant. It is all the more to be deplored, therefore, that any lax sense of responsibility should be manifested toward them by those who can afford to pay for their services. The large majority of practitioners depend upon their profession for the support of themselves and of their families; and it is the height of injustice to expect them to play the rôle of public benefactors to families who would not expect charity from anyone else. This disposition to take advantage of the profession is annoyingly manifested in the cities, where free medical service is provided at various dispensaries. It is a well-known fact that well-to-do persons frequently apply at these dispensaries, and so work a double injustice: toward the poor, who ought to have the time taken up by these persons; and toward the doctors, who should be employed by them.

It is probable that much of the lack of fairness and consideration evinced toward physicians is due to mere thoughtlessness. Many fail to reflect that the physician has a right to claim a proper interest on the money which he spent on the education that makes his services desirable, and that he must provide not only for the present necessities of those dependent upon him, but also for the time when his health and vigour shall decline and his work come to an end.

The word "cheap" has a double meaning; and those who look for a cheap doctor are apt to get cheap service, the last thing in the world that they are disposed to put up with. A physician is something more than a tradesman, and cannot afford to quote "wholesale prices on a large order of goods," as some of his patients seem to expect of him. Each separate expenditure of time, skill, and energy costs him equally as much, and no number of repetitions can justify a demand for a reduced price.

In many cases where a physician is employed by a lodge or similar organisation, there is a tendency to overburden him with work and to reduce his fee to a minimum. These organisations also admit to membership persons who are well able to pay regular fees, and permit them to make use of the lodge physician. Frequently, also, individuals in good circumstances will form sick-funds in order to get medical advice cheaply. Such arrangements are made possible by the fact that the supply of physicians exceeds the demand. This state of affairs, however, tends to correct itself; and as a consequence of the severe competition for a livelihood now existing in the profession, fewer men are taking up the study of medicine. This diminution in the number of medical students will benefit not only the profession but also the public at large; for cheap advice is seldom the best advice,

and the imperative necessity of gaining some sort of livelihood under adverse circumstances is apt to have a deleterious effect on the quality of a physician's work.

In contrast with the conditions alluded to in the foregoing, many families maintain with their physician the most admirable relations, based upon well-warranted respect and mutual friendship.

Some families have no regular physician, but call in anyone who is convenient in time of sickness. There are obvious disadvantages connected with this mode of procedure. An intimate knowledge of the peculiarities of a family, the previous ailments of its members, etc., is of great value, and can be acquired only by the family physician. It is always imperative that the attending physician be given an accurate and detailed account, and that nothing be concealed which might prove of importance. It will be easier to confide in a physician who is called in regularly, than in a stranger. The former will have a higher sense of responsibility, his relations to the entire family will be more intimate, he will often be able to arrive at a diagnosis more quickly, and he will make allowance for peculiarities and idiosyncrasies of the family. On the other hand, a physician called in but once finds himself in an altogether different position. He usually takes into consideration only the details of the present case, makes his diagnosis accordingly, and orders the necessary treatment. It is quite possible that the advice given is such as can be carried out only with great sacrifice, although a knowledge of the family circumstances might have enabled him to make it practicable with very slight changes. Because the physician is a stranger, however, the family does not feel free to explain the situation, and its members keep to themselves their distress at hearing the physician order some course of treatment which the patient's means will not permit. This is only one aspect of the matter in which the regular family physician has the advantage over the one casually summoned, and others will readily suggest themselves. In small towns a frequent change of physicians is often occasioned by the fact that all the local practitioners are known to their neighbours, who, for social or business reasons, may wish to favour all alike.

In large cities competent specialists are frequently called for particular emergencies. It requires, however, considerable medical knowledge to determine in which cases a specialist is required; and to decide this belongs to the sphere of the family physician. Specialists are highly desirable, since certain methods of examination and treatment demand a skill and experience which can be acquired only by exclusive devotion to a limited branch of medicine; but only a physician who is versed in the entire domain of the profession is competent to decide as to the necessity for a specialist in a given case. In lodges such decisions are commonly made by the lodge physician.

If possible a physician should be chosen before his services are required, and should be instructed in all details pertaining to the patient's habits, etc. The question of fee might also be settled, since otherwise it may give rise to misunderstandings. Once the physician is engaged, his advice should be scrupulously followed, even before illness has set in, since much can be accomplished toward the prevention of disease. Hygiene, the science of the cause and prevention of disease, has advanced of late years with such mighty strides that observance of its rules is even more effective than the actual treatment of the disease.

Measures to stay the course of an affection become less effective as it advances. It is therefore desirable to resort to medical aid at the beginning of a disease, even if the symptoms do not appear alarming. By doing so the patient may appear over-anxious, but it will frequently enable him to avoid a serious outcome. If the doctor is notified early he will not only succeed better with his treatment, but will economise energy himself. If, for instance, he is informed in the morning that his presence is desired, he can divide his work better and make his more urgent calls first ; whereas an urgent call later may not find him at home, and he may have to travel long distances unnecessarily, and end by making but a hasty visit.

This practice of prompt appeal to the doctor will also do away with many of the night-calls which are such a tax upon a physician's energies and endurance. It is extremely inconsiderate, even cruel, to call out a physician at night unnecessarily. Sudden emergencies certainly do arise in which this is necessary ; but often the decision to summon the physician is reached at night merely because an illness, perceptible in the morning, but seeming at that time trivial, has failed to improve, or even, as often happens toward night, has become more serious. It is in such cases that an earlier summons to the physician would spare him much unnecessary exertion, and the friends of the patient considerable alarm and anxiety. No physician resents a really imperative night-call, and it is better to make ten unnecessary visits than to refuse aid in one case where it is really needed ; but it rests with those who employ the physician to use consideration and good sense in this matter.

On the other hand, although it is not advisable to ignore the first symptoms of disease, a physician should not be troubled with too trivial matters. Nothing is more annoying than such foolish demands; and he who too often misuses the services of a physician may find them denied him at a critical moment.

The troubles of a physician begin when he is confronted with a really serious disorder. If he does not diagnose the case promptly, his ability may be questioned ; if, on the other hand, fearing to lose prestige by delay, he makes a hasty diagnosis which developments compel him to change a little later, the distrust engendered by this mistake will be even greater.

As soon as the diagnosis is established, the prognosis of the disease begins to worry the relatives, and in many cases they insist that the physician tell them in advance every detail of the course. It is perhaps but natural that their anxiety, working with their sense of the doctor's superior knowledge, should tend to make them demand the impossible of him, but a little common-sense and reflection should convince them of the folly and unfairness of so doing.

In protracted illness friends are often consulted, and such consultations are fraught with peril to the physician and his patient, since remedies are suggested and criticisms made with a freedom in no way restricted by utter ignorance of the subject. In this way distrust of the physician is fostered, which, if continued, may result in the calling of another physician or in a demand for a consultation. In either case the attending physician should be informed of the action taken. In case a second physician is to continue the treatment, it is desirable that the first attendant formally transfer the case to him. A knowledge of the previous history is indispensable to the latter, and will prevent mistakes that might easily occur if he took charge of the case without knowing its previous course and treatment. Furthermore, it is the height of folly and unfairness to consult someone else behind the back of the regular attendant. Contradictions, often more apparent than real, will arise, and cause confusion, in which the patient's relatives do not know which to trust, and end by distrusting both. Secrecy can rarely be maintained for long ; and it may easily happen that both physicians will refuse, with perfect justification, to continue the treatment when they discover the real state of affairs.

In protracted diseases it may frequently seem as if the knowledge and skill of the physician have been exhausted without obtaining the wished-for cure ; and it is under such circumstances that patients are apt to turn to so-called " natural healers," who promise a cure unconditionally. The term " natural healer " is a good advertisement, since all look upon Nature as the most able physician, and all who pursue the study of medicine spend years in seeking inspiration from natural processes. It need therefore cause no surprise that one who claims to cure under the direct auspices of Nature will attract patients. An investigation of the character of natural healers, however, generally discloses the fact that they are laymen who claim to cure diseases without the necessary scientific foundation and without scientific methods of treatment. They have recourse to only a small number of remedies, and one can tell in advance of what their treatment will consist, since no attention is paid to the character of the disease. One might as well choose any one of the mineral waters and drink it ; it *may* be good for many conditions and even for the present illness, but it may also do harm. Even the most innocent remedies administered in this irresponsible fashion may do harm, if for no other reason than that valuable time is lost, during

which the disease, without proper treatment, is passing from a curable to an incurable stage.

Occasionally the physician is required, not to treat a patient, but merely to fill out a medical certificate. Many look upon this as a mere form, and cannot see that it need matter to the physician whether the contents of the certificate are true or not. Yet no one who respects and confides in a physician should expect dishonesty of him as a favour. It would seem sufficiently obvious that such lack of scruple is incompatible with the very qualities that make a physician trustworthy and safe.

These are only a few of the varied phases appearing in the relations between physician and patient. It is impossible to discuss all of them in this place, but enough has been said to indicate that the essentials of those relations are founded on a basis of mutual esteem, goodwill, and confidence.

THE JOURNEY OF LIFE AND THE LAWS OF HEALTH

By Alfred T. Schofield, M.D., M.R.C.S.E., London
(*Vice-President National Health Society*)

WHAT, THEN, IS LIFE? It may be described as a condition of ceaseless change caused by the constant operation of the two opposing forces of repair and decay. Hence it has been well called a condition of "dynamic equilibrium," or a balance maintained by the action of opposing forces; in contrast to a condition of static equilibrium, or an equilibrium dependent on an inherent state or construction. A pyramid, for instance, is in static equilibrium; a balance with an equal weight in each scale in dynamic equilibrium. Comparing life, then, for the moment, with a balance, the weight on one side being decay, on the other repair, we find that, actually, the two never at any time exactly balance each other. From birth to the period of greatest vigour, a period varying in individuals, but averaging, roughly speaking, about thirty-five in women and forty in men, the "repair" weight exceeds the "decay"; the difference, however, at first very gently, getting less and less as the climacteric, or top of the hill, is reached. From this point the "decay" weight begins, at first quite imperceptibly, but with gradual and steady increase, to exceed the repair, until the end is reached in death.

Before, however, more closely surveying the journey of life, let us consider its essentials. These, as laid down by Kirkes, are "birth, growth and development, decay and death."

All Life by Inheritance.

BIRTH simply marks the definite commencement of separate existence, and is an essential of every living thing, in that it implies that all life, without exception, is got by inheritance, and never, as far as we know, commences *de novo*. Before the days of exact research the contrary was believed to be true, and the presence of life in decaying animal and vegetable matter was supposed to prove that life could exist without previous life. It is needless now to show how the progress of science proved

this to be a fallacy, and that every form of the lowest bacteria or smallest animal did and could only spring from a parent of the same species. The theory of spontaneous generation is now everywhere proved to be false, and where adequate care is taken to exclude life from animal matter, no decomposition takes place, and no living forms are found.

Growth is not confined to living beings, but in them takes place in a totally different way from that in the inanimate world. In a crystal, for instance, or in rock-formation, growth takes place by the mechanical addition of layer after layer, the mass itself taking no part in the process; and it continues, moreover, indefinitely. In a living organism growth is the result of change and increase in every part throughout the being, and this growth has strict limits, beyond which it cannot continue.

Development is a quality that has no parallel in the inanimate world. As growth is an increase in quantity, so development is an increase in quality, being the perfect adapting of means to ends, of machinery to work through continual use. Every organ of the body, including the brain, is thus developed by use, and becomes not only larger, but stronger, and better adapted for its work. An interesting description of development in mental qualities is found in the Bible in Hebrews v. 14: "Who *by reason of use* have their senses exercised to discern both good and evil."

An Incessant Accompaniment of Life.

Decay is now understood to be a constant manifestation of life. It used to be thought that life consisted in a power to resist decay, and it was only when life ceased that decay commenced. It is now found not only that decay is an incessant accompaniment of life from birth, but that it is positively more active during life than afterwards. It is true that during life the effects of decay are not then obvious, as we have seen that on the other side of the balance is the opposite force of repair or growth which serves as a counterpoise to keep the body in "dynamical equilibrium" (an expression we have already explained); but when the summit of life is passed, repair gets more and more feeble, and at last ceasing in death, leaves the field free for the ravages of decay. Life is not, then, a power that resists decay, but, on the contrary, is a force that cannot be manifested without it; every movement, every look, every thought, involving the decay and destruction of a certain amount of body-tissue.

Death is a phenomenon quite peculiar, and necessarily so, to life, for it is obvious that nothing can cease to exist save what has lived. But it is not so much an interruption of life, as the final attainment of an end which was held steadily in view from the beginning, and towards which every act of

life tended. Exactly as every beat of an eight-day clock is a step towards the final running down of the weight, which is definitely arranged to take place at the end of eight days, so every movement of the body, and every day that it exists, is a step towards that end for which it was constructed ; every body being made exactly like a clock, to run a definite time. Of course it may be stopped before (as a clock with the finger) by disease or accident. In death, repair has for ever ceased, and decay alone remains.

What special power, then, has this life that presents this orderly sequence of phenomena peculiar to itself ?

Consider for a moment the difference between a fertilised egg that will hatch and produce a chicken, and thus contains life, and one that will not. At first they appear exactly alike, and contain the same albuminous compound. Apart from external force, the living egg has no advantage over the dead one ; but let heat, which is a most potent form of energy and force, be applied to each, and it will be seen in a few days that the "life" in the one egg is a capacity to appropriate and use this force, and eventually to manifest it in the production of a chick—which chick, in common with all other living beings, must continue to appropriate force in the shape of heat, light, food, etc., or the life ceases. In the other case the same heat applied to an organic substance that does not possess the power, or life, thus to use it, simply hastens decay and decomposition.

The Storage of Life-force.

Life, then, is a special power inherent in the living cell which uses external force and manifests it in special phenomena, but it is not a force or energy that is self-subsisting, being, on the contrary, wholly dependent for its existence on the common forces of Nature.

THE DIFFERENCE between animal and vegetable life is simple and important. Vegetable life can appropriate force from inorganic matter. It decomposes carbonic-acid gas and ammonia by means of a substance called chlorophyll (which is the green colouring matter in the leaves and stalks of plants), and then stores up the carbon and nitrogen as force to be used hereafter. This life principally consists in the storing of force rather than in its manifestation. Animal life, on the other hand, takes these stores, and in reducing them again to their simple elements of carbonic acid and ammonia, evolves and uses up the force they contain. Animal life, therefore, largely consists in the manifestation of energy.

A vegetable may be compared to a hard-working father accumulating

large stores of wealth, while the animal rather resembles the spendthrift son who dissipates it all.

Just, however, as it may be noted that large parts of vegetables (the layers of bark, etc.) are lifeless, and yet subject to such slow change as to resemble minerals, so animal bodies contain many processes by which force is stored and not expended, therein closely resembling vegetables.

The animal not only thus uses the force of the vegetable world, but is absolutely dependent upon it, for it is not able to use force directly from the inorganic or mineral world, but only after it has been stored and changed by the organic or vegetable.

Three Stages of Life.

Having thus briefly considered the general question of animal life, let us review its various stages in man. We need not divide these into more than three—

1st. Growth, from 1 to 25 years.
2nd. Maturity, from 26 to 50 years.
3rd. Decline, from 51 to 75 years.

In the first we mount the hill of life; in the second, traverse an apparently level tableland, though in reality no part of life is absolutely level, or, in other words, at no time are the forces of repair and decay exactly balanced; and in the third, slowly descend the hill on the other side to the level whence we started.

The first stage is that of infancy, childhood, and youth, and is throughout the twenty-five years a time of growth and development It is a time of storing and building up rather than of using, and it is of the utmost importance that this be recognised by all. The human being possesses three natures in one body—the spiritual or moral, the intellectual or mental, and the physical or bodily. All three require during this period abundance of wholesome food, and exercise suited to growth rather than display. First, good spiritual and moral food, thus enabling the being to take his right place in the spiritual world. Next, sound mental and intellectual food, specially adapted to enable the being rightly to fill his destined place in the intellectual world; and lastly, but not leastly, but in reality first of all, abundant food for the body, commencing with milk and continuing with a generous mixed diet, forming a sound and well-developed body, fitting its happy owner to take his due place in the physical world.

Every human being is born with certain inherent capacities as to length of life, quality of mind, and stature of body, etc.; but abundance instead of

deficiency of food and exercise can make a difference of three inches in height and two stone or more in weight in the body, and differences in like degree in the mind.

It may be interesting here to note the rate of growth. A child at birth should be a quarter of full height; at 2½, a half; at 10, three-fourths; and at 18, the full stature.

THE SECOND STAGE of life's journey is that of maturity, of more perfect "dynamical equilibrium," the opposing weights being now fairly evenly balanced, and of general good health. Up to this time the man's enemies have chiefly been from without, now they are more from within, "those of his own household." All states of health, it must ever be remembered, depend upon two things: 1st, on the amount of exposure to injury; and 2nd, on the power of resistance to injury. The first is under our control, the second largely beyond it. A large majority of the race are constructed to live from seventy to eighty years or thereabouts, and yet in England only one in ten ever reaches seventy-five. Most people die prematurely through needless exposure to injuries, such as: Infection, improper food, excessive drinking, impure air, dirt of various kinds, exposure, accidents, unhealthy occupations, improper clothing, etc. During this second stage a man's chief dangers arise from inflicting needless injuries on himself.

The Summit of Life's Journey.

Exercise, which there is now a tendency to neglect, should be carefully kept up, not only for the body's sake, but as affording the best relief to an overtaxed brain. The best time for marriage is not less than ten years before the summit of life's journey, which in men is about forty, in women about thirty-five, thus making the best age for wedlock not later than thirty and twenty-five respectively.

At forty and after, great attention should be paid to maintaining the same bodily weight, any great increase or decrease being dangerous. Exercise and diet can do this to some extent, for exercise till a man perspires decreases weight; if only till he is warm, it increases it.

At this period the brain is at its strongest, and can be freely worked.

We now reach the decline of life. In this THIRD STAGE the intellect may for some time remain remarkably clear and bright, but the body always gets feebler. At this period there must be no over-eating, which is more dangerous now than ever. There must be no careless exposure to cold or wet, and the body should be always kept warm, artificially if need be. The life should contain varied interest, without undue excitement or

worry. The body in this stage returns to more of a vegetable existence, very little energy being manifested towards its close, save that needed to maintain life. At last the end is reached, and a natural death, in contrast to a violent death, closes the scene. A natural death is the running down of the clock ; a violent death is the premature stopping of it by accident, or disease.

As will be seen, the guiding principle throughout the journey is a wise self-denial. Some may ask, *Cui bono?* In the answer it must be remembered that he who makes a healthy life his aim and end becomes a hypochondriac, and defeats his very purpose ; but he who looks on health and life as but means and opportunities, looks higher and further for his aim and end, and learns that

> Man lives in deeds, not years ;
> In thoughts, not figures on a dial.

We have only one life to live. Let us not then waste it, but seek to embody in our every action Lowell's noble words—

> Do greatly ; though but a line, make it sublime,
> Not failure, but low aim is crime.

Health, Wholeness, and Holiness.

These three words come from the same root, and serve to emphasise the point of view from which this work is written, which is an essentially broad and comprehensive one ; treating health and ill-health in relation to the entire man as man, and not, as is invariably the case in so-called "Health Manuals," in relation to his body alone.

To say that a man is in perfect health who has a distorted mind or a distracted soul is absurd, for illness is to the body as sin is to the spirit ; therefore disease may be called sin of the body, and error or misery sickness of the soul, the man being in neither case in a state of health or wholeness.

Professor James insists that the health of the man consists essentially in the harmony of body, soul, and spirit, in their relations with one another and with their environment. Herbert Spencer, again, has given us the same thought when he says that health is perfect correspondence with our environment, ill-health is imperfect correspondence, while death is the result of the failure of all correspondence. Health, then, is the "wholeness of life."

Five Classes of Health.

The most healthy person must die, but the general object should be to die a natural death, and to live a healthy life. Men are not only born unequal with regard to the power and capacity of their lives, but also with reference to the length of them. Both health and length of life are, to a great extent, a question of heredity.

With regard to the former inequality, Sir B. Ward Richardson makes five classes: 1st, the perfectly healthy; 2nd, the healthy; 3rd, the healthy till old; 4th, the frequently unhealthy; 5th, the constantly unhealthy; of this last class, he says the average life after twenty-five is not more than fifteen years.

Disease is not Inherited.

With regard to hereditary ill-health, however, we must here make one important remark, and that is, we do not inherit diseases, but tendencies to disease, which may be and are successfully overcome. It is a sorry and false fatalism which declares that a drunkard's child is necessarily a drunkard. On the contrary, the glorious truth is this: all these tendencies to drink, gout, consumption, and the like, can not only be successfully guarded against and prevented if the tendency be known, but that if thus resisted through three generations the very tendency disappears in the fourth, and the weakened lung tissue, or digestive apparatus, with morbid craving, is absolutely and finally stamped out.

I call this a "glorious truth," and the language is not exaggerated, for it not only delivers the individual from the "dead hand" of heredity, but it shows that by improving his own health he must benefit the future generation with a cumulative force.

Heredity, however, shows itself not only in health but in length of life, and it is in this that the secret of longevity mainly lies, and although this can be altered by the habits of the individual, the power to add to his days is very slight compared with the ease with which they are shortened.

How to Calculate Life-force.

Each person is born into this world with a certain amount of life-force, and is constructed to go for a certain number of years—like a clock. The length of time any individual may expect to live may be roughly calculated by dividing the sum of the lives of his six ancestors by six and

adding or subtracting one year for every five that the result exceeds or is less than sixty, thus—

Paternal grandfather	died at	67
,, grandmother	,,	82
Maternal grandfather	,,	90
,, grandmother	,,	45
Father	,,	72
Mother	,,	63
Sum of 6 is ...		419÷6 =69 years and 5 months.

To this two years may be added, as it is about ten years in excess of sixty, showing that the individual roughly is constructed to live for seventy-one years and five months; and if he does, he then dies a natural death—that is, a death from failure of life power, and not from being cut off prematurely by disease or accident. And yet, only one in nine in this country thus die, and this work is largely written for the other eight, who die premature and unnatural deaths. The number that attain to seventy years of age is in Norway one-third of the population, in England one-fourth, in France one-eighth, and in Ireland one-eleventh.

It is computed that, apart from disease, the ordinary span of life is five times that of growth; and fixing this latter at twenty-one years in the human race, men should die between 100 to 105 years. When we remember that the average duration of life here, with every advantage of sanitation, is still but forty-three years (men forty-two, women forty-four), that within my memory it was only thirty-six, that in the eighteenth century it was but twenty, we see what a mighty work still remains to be accomplished in perfecting the science of hygiene, or prevention, as distinguished from that of medicine or cure.

Seven Years Added by Sanitation.

It is encouraging, in this connection, to see what sanitation has already done. As I have said, within my memory the span of life in this country has been increased from thirty-six to forty-three years, which means that every child now born has seven years (on an average) added to its life!

In mediæval days the average span of life, instead of being forty-three, was, in the seventeenth century, as low as thirteen. No wonder, then, men were considered very old before they were sixty, which nowadays is but advanced middle age. Sanitation has lowered the death-rate in old cities one-third, in new towns one-half. All this is encouraging, and leads us to expect still greater results.

Ill-health is Loss of Balance.

Ill-health is when the balance, the equilibrium of destruction and repair, is lost, and the weight in the scale of life is greater on one side than the other, generally on the side of destruction. When it is entirely on this side, and repair has ceased altogether, the result is death.

There are, I believe, some eleven hundred varieties of ill-health or diseases, though there are only three ultimate varieties of death—through failure of the nervous system, or *coma ;* through failure of breath, or *apnœa ;* and through failure of the heart, or *syncope.*

Ill-health is preventable or not preventable. Forty years ago a great many diseases were thought to be not preventable that are now constantly prevented. Amongst them we may mention the whole circle of the infectious fevers, including typhoid and cholera as well as consumption, and sometimes cancer. Indeed, it is now difficult, if not impossible, to point to one absolutely non-preventable disease.

Ignorance, Carelessness, Wilful Neglect.

Why, then, do eight out of nine people still fail to live out their days, and die before their time ? Why is the average expectation of life to-day forty-three, instead of seventy-five or one hundred ? There are at least three great reasons—ignorance, carelessness, and wilful neglect generally—and especially of the five laws of health.

Ignorance of these simple laws in their application to the individual is still very common amongst the educated (?) classes, as well as among all other members of the community. *Carelessness*, to which, besides many diseases, nearly all accidents and infectious fevers are due, is found everywhere ; and is of a very different type from the wise carelessness I have advocated elsewhere. *Wilful neglect* is, of course, the most sinful of all, and amounts morally to suicide, or even to manslaughter when it results in death, and takes on its most repulsive form as the cause of infanticide. It is said that the most fatal of the three is wilful neglect, carelessness being less so, and ignorance, with which is allied superstition and quackery, being least fatal of all.

200,000 Needless Deaths every Year.

It is unspeakably sad to think that some 200,000 die needlessly and prematurely every year in this country from these three wretched and

preventable causes, and that some seven millions are needlessly ill. What a loss this is to a nation's wealth may be computed when we remember that the average value of a man is £158 1s. 6d.; and perhaps this argument is not without force with "a nation of shopkeepers." And, yet, instead of shame being felt, too often the attitude is one of resigned complacency, the premature death being ascribed to Divine interposition! To my mind nothing can be more impious than to say that these miserable fruits of our own folly are the "will of God." So terrible indeed are the results of such neglect that I venture to assert that there is no single reader of these lines but can easily recall in his own family some lost member who (but for this) might still be alive and well. The other day I got the following letter from a well-known lady—a head of an old Scotch family:—

"How sadly I could have added my testimony to what you said to-day! For the dear ones whom I have lost in my own family might have been saved—all were lost to me through preventable illnesses; and how many a mother has gone through the same agony which might have been prevented had true knowledge been given her! Would that we could open the eyes of those who are careless on these subjects to the mistake they are making, and to the importance and necessity of instruction in these matters! Were people thoroughly aroused and convinced that their ignorance on this subject is positively culpable, I believe they would flock anywhere and everywhere to learn all they could."

The Causes of Disease.

We have alluded to the five laws of health—good food, good air, cleanliness, suitable dress, and proper exercise and rest.

Disease comes from two causes—predisposing and exciting. The former lays the train, the latter fires the spark that lights it. The principal predisposing causes of disease are sex, age, heredity, environment, and previous disease, while the exciting causes arise from breaking one of the five laws of health.

For example, BAD FOOD kills most of any, I think, being responsible for three-fourths of all infant deaths; while in adult life drink kills most, so that between the two, bad food and drink certainly take the lead.

BAD AIR is responsible for most lung diseases, which include three of the five most fatal diseases in this kingdom.

DIRT is the cause of all infectious diseases, and many others.

UNSUITABLE CLOTHING may not cause so many deaths, but is a most fertile source of ill-health of various kinds, while want of EXERCISE AND

REST keep the whole body in an unhealthy condition, and leave it a ready prey to disease.

Dangers of the Nursery.

If a child can live till it leaves the nursery it has a chance of growing up; an annual mortality of seventy per thousand under four years of age, dropping at once to six when over four. A human being never again enters such a fatal period as the nursery until he is over seventy-four years of age! And why? Because in infancy, when the child can do nothing in the way of self-preservation, ignorance, carelessness, and wilful neglect reign supreme, and the results are awful!

A young baby's life is as easy to snuff out as a candle, and twelve of them under four are snuffed out each year for every one over four; for by this time the organism is harder and better able to resist the carelessness with which it is still surrounded. I have no space here or I could prove this shameful truth to the hilt, both among rich and poor.

Two baby heirs to large properties, to my knowledge, only just escaped with their lives—the one through having its first bath in a draught, with the nursery door left open in February, the other by being fed on starch food when born. The poor are, of course, killed off wholesale, and all by the infernal trio (ignorance, carelessness, and wilful neglect) that I have spoken of.

Thirty Years of Good Health.

There is no doubt that from the time growth ends till old age begins—a time of some thirty years or so—should be a period of special good health, the organism being then free from disease of growth or degeneration. The two changes in life at about fifteen and fifty are times when some special care is often needed with regard to health. But if, during the thirty years I spoke of, health is firmly established as a habit, the latter period need not be feared. Habit is much in health, and when all the organs of the body have worked well together for years, they become hardy like seasoned veterans, and can go anywhere and do anything.

During growth, however, not only the body but the character is being formed, and if under four the dangers are chiefly due to the indiscretion of parents or nurse, after that age they become increasingly due to one's own, a constant source of danger. Finally, then, our endeavour should be—first, to live out our days and die a natural death, and secondly, to keep our health while we live.

Life and Health not to be Objects.

Not, be it understood, that either life or health are ever to be the object of our lives. At best they are but means to higher and worthier ends ; and anyone short-sighted enough to make them the goal of life will lose one if not both of them. No man is in health who lives to preserve his health, but the man is in the best of health to whom his God is first, his neighbour second, and himself last and least of all. These are they who eventually shall be first.

DREAMY MENTAL STATES*

By Sir James Crichton-Browne, M.D., LL.D., F.R.S.

(*Lord Chancellor's Visitor in Lunacy, London*)

Medicine is many-sided, and touches or is touched by almost all human affairs, and it has occurred to me that I might not unprofitably conduct you into a by-path of pathology, and ask you to consider with me certain mental conditions that are encountered in daily life, that have a literary and philosophical interest, and that are not, I believe, without great medical significance. I have therefore culled from the faded leaves of an old notebook some observations on curious, fleeting, but elaborate psychical modifications which have been designated "dreamy mental states," also "voluminous mental states," and likewise "intellectual *auræ*," and which have not yet received in this country the amount of attention they deserve.

The simplest form of these dreamy mental states—a sense of reminiscence it has been called by some, a sense of prescience by others ; and the application to it of such apparently contradictory names suggests that it is somewhat mysterious in nature and difficult of interpretation—is to be found described vaguely, but recognisably, in the writings of many of our most gifted authors. It consists in an impression suddenly taking possession of the mind, that the passing moment of life has been once lived before, or must be once lived again—that surrounding objects have been seen once before exactly in the relations in which they at the instant present themselves.

Says Sir Walter Scott, in "Guy Mannering" : "How often do we find ourselves in society which we have never before met, and yet feel impressed with a mysterious, ill-defined consciousness that neither the scene nor the subject is entirely new ; nay, we feel as if we could anticipate that part of the conversation that has not yet taken place."

I hope to show that these dreamy states, so far from being normal even in their slightest and simplest form, and occurring in presumably healthy persons, involve disorder of mind, trifling and transient no doubt, like

* Reprinted from the Cavendish Lecture [Bailliere, Tindall, and Cox].

cramp of a few fibres of a muscle, but disorder nevertheless, dependent on a defect of consciousness in one direction, indicated by vagueness as to present surroundings, and an increase of consciousness in another direction, indicated by the too vivid revival of former surroundings. There is in them a negative element in the loss of control of the highest centres, and a positive element in the raised activity of other nervous arrangements, permitting of new cerebral combinations, somewhat akin to those which take place during the activity of the imagination and flights of genius. If the sense of beauty is vision raised to a higher power, a dreamy mental state is memory diving to a lower than its accustomed level, and bringing to the surface deeply submerged personal annals, or even still more unfathomable ancestral traits. A dreamy state it may be conveniently called, and dreamy in some aspects it undoubtedly is, and yet, strictly speaking, it is not comparable to a dream, for it involves a residuum of object consciousness, larger than a dream contains, and a volume of subject consciousness to which a dream rarely reaches. It has peculiar features of its own, and stands in the same relation to a dream that the darkness of an eclipse does to the more frequently recurring darkness of night.

Elaborate Manifestations.

I have hitherto spoken of dreamy mental states of the most ordinary and uncomplicated type—those that are least removed from normality and consist in reminiscence ; but it must be pointed out that such states are of many different kinds, and that those that commence in reminiscence sometimes branch out into more elaborate manifestations. They have not yet been classified, and this is to be regretted, for the accurate observation and arrangement of them would in all likelihood throw much light on their nature, and almost certainly reveal that, notwithstanding their diversities, they often closely resemble each other as occurring in different individuals, and fall into several groups, corresponding, probably, with disorder of several different cerebral areas. As yet, however, all we can do is to enumerate some of their characteristics and varieties. The most general description of them is that they are indescribable, and transcend all common experience, and the crudest analysis of them discloses this much, that they consist in an exaltation of subject consciousness and a degradation of the power of attention for the time being, and are almost invariably concerned, however vaguely, with those ultimate scientific ideas—space, time, matter, motion, force, and the like—which are beyond the domain of certain knowledge, and, according to Herbert Spencer, unthinkable. Contrary to all experience, they have yet the highest experiential validity. They declare themselves

now as tamperings with those intuitions that yield the consciousness of continued existence, and again as excursions into that infinite field that lies behind appearances, and of which it is dangerous to affirm or deny anything. Plunges they are into these depths of outer mystery in which the certitudes of science lose themselves, and out of which, it has been said, the certitudes of faith arise.

The victims of dreamy mental states, striving to convey some notion of them, tell us that they consist in a feeling of being somewhere else—in double consciousness—in a loss of personal identity—in a going back to childhood—in the vivid return of an old dream—in losing touch of the world—in a deprivation of corporeal substance — in the loss of the sense of proportion—in momentary black despair—in being at the Day of Judgment ; and they supplement whatever phrases they use with the assurance that it is impossible to put into words such strange and incomprehensible visitations.

Interesting Memoirs.

A medical man who, above five-and-twenty years ago, contributed to the "Practitioner" an interesting memoir of his own case, said that he had suffered from boyhood from dreamy mental states of reminiscence, or a startling conviction that he had once before been placed in the exact circumstances in which he found himself, and that immediately before his first epileptic fit, which occurred in middle life, these dreamy states recurred with unusual frequency and intensity. "Since my first attack," he went on, "I have only had few recurrences of the feeling, but on two occasions these were followed the next day by an epileptic seizure." One patient of Dr. Hughlings Jackson reported that his fits began by "a sort of referring to old things that had happened," after which he lost himself ; another intimated that old scenes reverted for hours before the fit ; another said, "If I were walking along and had a fit I should think, 'Oh, I saw that before'" ; and a patient of my own, before each fit—and his fits were marked by violent convulsions and tongue-biting—had a similar impression, accompanied by intense terror and alarm. Dr. Joseph Coates, of Glasgow, has narrated the case of an intelligent man who stated that with few exceptions his fits had been preceded by giddiness and "a peculiar thought," as he expressed it. He attached great importance to this "thought," saying that if it were known his whole case would be explained, and although he could not tell what the thought was, he was confident that it was always the same. He always recognised it when it occurred, and tried to fix it in his memory, but he invariably forgot it when the fit was over.

I have endeavoured to indicate the morbid character and tendencies of dreamy mental states by illustrating their transition into epileptic seizures or interspersal amongst them, but this is not the only pathological transformation they undergo, for a history of them is now and then discoverable in those who have become insane without the intervention of epilepsy, and the passage from them into states of mental disease may occasionally be traced out.

Nerve Degeneration.

But not more by their transition than by their associations is the true character of dreamy mental states betrayed, for almost invariably they occur during impaired bodily health, or in states of exhaustion, or have bound up with them, either in the sufferer himself or in the family to which he belongs, other and unmistakable indications of nervous disease. They rarely stand alone, but have for the most part side by side with them other sure signs of a want of equilibrium or of degeneration in the nerve centres. Dr. Hughlings Jackson has reported a case in which dreamy mental states, consisting in the impression of having fallen down a coal-pit, were associated with epileptic seizures and left hemiplegia, due to a coarse lesion of the right hemisphere, and it is noteworthy that, of the distinguished men of letters whose confessions of dreamy mental states have been noted, Scott, Dickens, and Rossetti died of brain disease. A domestic servant who consulted Dr. Hughlings Jackson, when communicating to him the warning of her epileptic seizures, said : " It seems as if I went back to all that occurred in my childhood ; as if I see everything so quick and so soon gone that I cannot describe it." And dreamy mental states, apart from epileptic fits, have been recorded in which the whole coil of past existence seemed to be instantaneously unrolled. I think, had I time, I should be able to show that what used to be known in Scotland as second-sight was sometimes only one of these states with a prescient intention.

. . . I should now like to say a few words about their consequences, or the effects they exert on those who experience them. When they are linked with epilepsy or other serious nervous disease their effects are, of course, merged in those of the graver malady ; and when they are an insulated ailment it may be questioned whether they have any effects that are clearly distinguishable. They carry with them, except when occurring while those who experience them are in positions of peril, no risk to life. They do not tend to self-perpetuation to anything like the same extent as epileptic fits, for in many instances they are, as it were, excrescences of childhood and youth, and wear themselves out in middle age. Even when

they cling for life, it is often impossible to attribute to them pernicious results, and yet in many cases they do, I believe, have consequences of a painful and crippling description.

That dreamy mental states may persist throughout life without appreciable detriment to body or mind is, as has been said, undoubtedly true ; but the same thing is true of epilepsy, which does occasionally go on into extreme old age without apparent impairment of intellect or general health. It is sometimes even hinted that epilepsy, or the *morbus sacer*, is advantageous to intellectual development. We are told that Julius Cæsar, and Mahommed, and Marlborough, and Napoleon, and Wellington were epileptic, and are led to infer that that disease is almost an essential condition of great military genius ; and the names of Molière, and Sheridan, and Balzac, and Flaubert, and other eminent writers, who have been epileptic, are mentioned in order to suggest that that disease is sometimes an ingredient in literary talent. But a strict examination of all such cases brings out the truth that when epilepsy did not come late in life as a result of cerebral wear and tear, it did not promote, but to some extent marred, the genius or ability on which it was grafted. No doubt cases are encountered in which lifelong and violent epilepsy has proved not incompatible with great and sustained mental vigour. I have known a magistrate who at eighty years of age was a model of shrewdness and industry, and was still taking an active part in county business, and who had from puberty suffered from epileptic fits at short intervals ; and there are, I believe, men similarly afflicted now filling important public positions with usefulness and distinction. . . .

The Blight of Epilepsy.

But such cases are exceptional. The rule is that epilepsy is a blighting, a disabling, a destroying disease. Our asylums, workhouses, prisons, and hospitals are full of the débris of its storms, and the flotsam and jetsam left by these may now and then be recognised floating hopelessly in the stream of population in our streets. And so, if dreamy mental states may co-exist with brilliant intellectual powers, with nominally robust health and energetic character, they may also, on the large scale, tend to undermine the mental and bodily constitution. It is difficult to gauge their effect. Even when occurring in great men they may to some extent limit the greatness to which they are attached, and in ordinary men they do assuredly sometimes blunt the fine edge of talent, and induce dulness and stupidity, or lower the breaking strain of the brain. When they occur at wide intervals, their effects are probably immaterial ; they are so slight

and fugacious as to escape notice. But when they come very frequently or in batches, I have seen depression, mental torpor, and even temporary dementia, resulting from them. They tarnish for a time the brightness of the brain, and reduce the power of resistance of those who suffer from them to other morbific agencies.

Seeing, then, that dreamy mental states, although occasionally an appanage of genius and often innocuous, sometimes lead up to epilepsy or insanity, sometimes are one of a series of morbid events, and sometimes impair the faculties of those who suffer from them, they are surely worthy of medical observation and research. Especially in children and in the young should they be sought for and studied. If we want healthy and vigorous men and women, we must begin with the babies ; and if we want strong and stable brains, we must see that their foundations are well and truly laid in the springtime of life. Flaws then overlooked may cause disastrous subsidence long after, and as dreamy mental states are flaws, I advocate their detection if possible while they are still remediable. I do not suggest that mere children should be promiscuously subjected to crooked questionings, have strange fancies put into their heads, or be encouraged in introspection ; but I do counsel that when children exhibit anomalous nervous symptoms, forgetfulness, lethargy, paroxysms of passion, immorality, tremors, habit spasms, odd movements or tricks, insomnia or headaches, the possibility of dreamy mental states being present should not be overlooked. A few skilful exploratory queries by the doctor will generally bring them to light where they exist, even when they have long been scrupulously hidden away, and their discovery will be a great relief to the little patient and a guide to treatment.

Restriction of Diet.

As regards the treatment of dreamy mental states, it need only be said that it does not differ from that of cerebral neurasthenia and epilepsy. In almost all cases in which these states mount to such intensity as to demand treatment, there is a lowering of the standard of general health and inferentially abnormal nutrition of the brain ; and it would seem, indeed, that they depend on the reduction of cerebral nutrition to an inferior level in whole or in part, and to an attendant increased instability in the brain tissue. In those who suffer from them habitually they become aggravated in character during periods of ill-health and exhaustion, and in town-bred children they are often connected with anæmia, excessive mental fatigue, or debilitating habits. Rest and liberal nourishment rarely fail to alleviate, and sometimes remove them altogether, but the rest must be adequate,

and the nourishment wisely chosen. A diet too rich in animal food has seemed in one case in which I have seen it tried to make dreamy states worse than they previously were. This is indeed what we might have expected. Shakespeare, in "Twelfth Night," makes Sir Andrew Aguecheek say, "I am a great eater of meat, and I believe that does harm to my wit"; and whatever the effect of a liberal diet of animal food may be upon the healthy understanding, there can be little doubt that it is prejudicial to the mental powers of epileptics. One of my late colleagues, Dr. John Merson, carried out at the West Riding Asylum in a very masterly way a series of observations bearing on this point. He placed two groups of epileptic patients on a nitrogenous and farinaceous diet respectively for a fixed period, and then for a like period he changed the dietary of the two groups, giving those patients who had had a farinaceous diet a nitrogenous one, and those who had had a nitrogenous diet a farinaceous one. The patients on whom he experimented were of a chronic and confirmed class—patients in whom long-continued epilepsy had resulted in mental deterioration; and yet even in them marked results were obtained. In fourteen out of twenty-four cases there was a decided decrease in the number of fits during the farinaceous diet, and in a very considerable number of cases it was observed that soon after the nitrogenous diet was commenced mental dulness and stupidity supervened, the patient passing into a state of hebetude which only disappeared when a farinaceous diet was again resorted to. Dr. Sydney Short, of Birmingham, has made observations on the same subject, and has found that in a number of epileptic patients, also of a chronic class, and inmates of the City Infirmary, a partial withdrawal of meat from their diet was followed by a diminution in the number of fits.

Practical Data Needed.

What we now urgently need are accurate and extended observations on the influence of diets of various kinds, including and excluding several classes of constituents in epilepsy and allied conditions, and experiments, scientifically devised and carefully guarded, with drugs. We possess remedies which have elective affinities for certain nerve-centres, and which, therefore, promise to be useful in epilepsies of certain kinds; and, for my part, I will not believe that there is any finality in treatment, short of complete cure, or that we have not in store for us the discovery of means of dealing with epilepsy and its allies even more potent than that medicine which Sir Charles Locock, with such happy perspicuity, placed in our hands as a weapon against them at the very time when it had been omitted from the London Pharmacopœia because of its supposed uselessness and inertness. It is

disheartening to reflect, however, that so little is being done, and that the material at hand is not more largely utilised. There are in our asylums and workhouses to-day an enormous number of epileptics, the majority of whom are, I believe, as far as medical treatment is concerned, left to jolt down the hill of fatuity headlong and heedlessly, or with only the temporary application of the bromide brake now and then.

The fact that dreamy mental states are sometimes at first and to some extent under voluntary control, so that they can be induced or arrested, affords ground for the hope that well-ordered education and mental discipline will yet be made to contribute largely to brain health. Hitherto the education of the schoolmen, with all its advantages, which I would be the last to disparage, has, alas! been responsible for much cerebral sorrow and ruin. Let us hope that education, when carried on on physiological lines will conduce to peace and stability in the higher nerve-centres. Let us hope, also, that a further investigation of the moral treatment of disease will put us in possession of methods of controlling mental metabolism—if I may coin the term—more powerful and exact than any as yet devised, We shall some day, perchance, be able by certain courses of study to massage the brain, as we now do the body, and by certain definite exercises to bring successively into hygienic activity all the faculties of the mind as Schott now does the muscles of the trunk and limbs.

THE PREVENTION OF CONSUMPTION AND OTHER FORMS OF TUBERCULOSIS

By Sir William H. Broadbent, Bart., K.C.V.O., M.D., F.R.S.

(*Late Physician-in-Ordinary to the King and Prince of Wales*)

UNTIL the last few years the idea was that consumption was a disease which was in the family, a constitutional tendency which could only be accounted for by heredity and against which it was in vain to strive, an inevitable evil to be submitted to as a decree of inscrutable Providence. Added to this was the impression that it was incurable, and thus efforts to prevent and cure it were paralysed. Both these ideas, I am thankful to say, are wrong. Tubercle is not inherent in the constitution. Consumption is not an inevitable disaster, inflicted by a mysterious fate; it is, on the contrary, one of the products of men's ignorance and carelessness. We now know how it is brought about, and it is within the power of man to prevent it. Consumption is "caught," to use a familiar expression, from a pre-existing case; not, let me add at once, communicated directly from person to person by breathing the same air or even sleeping in the same room. There is no need to aggravate the sufferings of the phthisical patient by treating him as a public danger; no need to drive wife or child out of the house to save the rest of the family.

The agent in the causation and transmission of the disease is the tubercle bacillus, a minute rod-like organism, which multiplies at an amazing rate. It is visible only under very high powers of the microscope, and then only after careful staining. The bacilli obtain access to the lungs or to other organs, and if they find the soil suitable, and if they are not destroyed by the defensive agencies which are happily present in the system, they proceed to increase and multiply, compressing and blocking the minute blood-vessels and lymphatics, choking the air passages and air vesicles of the lungs, and forming the little pin-head solid bodies which

gave rise to the name tubercle. Eventually, the nutrition of the structures is so interfered with, that they lose their vitality; inflammation is set up, and the result is that the tubercles and the portion of tissue invaded by them soften and break down, forming small cavities which extend and coalesce till cavities of considerable size result. This is not the only harm they do, for besides damaging and destroying the tissues they form a poison or toxin which is absorbed into the blood, and by its presence in the circulation gives rise to the fever, sweating, and wasting which attend consumption.

Vitality of Microbes.

We should naturally suppose that these tubercle bacilli being present in diseased lungs by millions would be carried out by the breath, but this is not so. They are not found in the moisture condensed from the breath upon a piece of cold glass or metal, or in fluids through which expired air is made to pass. But they are contained in countless numbers in the expectoration and become the means by which the disease is disseminated. These microbes are possessed of extraordinary vitality, even outside the body, but there are certain agencies which they cannot resist—heat, sunlight, and fresh air. Fresh air and sunlight are, in fact, the great enemies of all pathogenic organisms. The drying of the expectoration, however, does not kill the tubercle bacillus. Apparently, on the contrary, the desiccated organic matter serves as a protection to the bacilli, so that in the form of dust they survive indefinitely. The expectoration, then, of a consumptive person upon a pocket-handkerchief, or accidentally contaminating articles of dress or the carpets of a room, may sooner or later take the form of dust and so be carried about in the atmosphere. But careless people will spit about in the streets and roads, and, when not under observation, in railway carriages and other public conveyances, in public buildings, especially in the corridors and passages, perhaps even in churches or chapels. This is not only nasty but dangerous. There is always the possibility that it may get dried, perhaps on ladies' dresses, which it contaminates, and be dispersed as dust, and it is by the inhalation of germ-laden dust that the seeds of phthisis are planted in the lungs.

We do not realise how ubiquitous dust is. We scarcely know where it can come from when we see it lying on papers, furniture, picture-frames,

windows, and in the holes and corners into which the diligent housemaid pursues it. You have all seen the motes dancing in the sunbeams crossing the room; you can see them in the rays of a lamp. Every mote is a dust particle which may possibly carry on its person numbers of tubercle bacilli. This is how consumption is usually contracted. In every breath we take we inhale an incalculable number of motes or particles of dust of a more palpable form. Some of these may elude the defences which Nature has planted in the respiratory passages, the filtering arrangement in the nose for entangling and arresting microbes, and the cilia of the windpipe and bronchial tubes, and reach the air cells. Then, supposing they happen to convey bacilli, if the local and constitutional conditions favour their development, the mischief is done. Let one bacillus out of a million find its way to predisposed lungs and consumption will be rife.

Milk and Tuberculosis.

But there is another way in which tuberculosis is disseminated, and that is by means of milk. Cows are very subject to tuberculosis, and at a certain stage of the disease tubercle bacilli are present in the milk. It is through milk so contaminated that children come to have tabes mesenterica, tuberculous disease of the bowels and mesenteric glands (better known, perhaps, as consumption of the bowels), and, directly or indirectly, tubercular meningitis, or acute hydrocephalus. The disease of bones and joints to which children are subject are probably also traceable to milk; humpback, hipjoint disease, and the diseases of knees, elbows, etc., which cripple so many children; perhaps so is lupus; and no doubt tubercle is often implanted by milk in early life which develops later into consumption. While blaming the cows we must not forget that a consumptive mother may not only be wasting her own strength by suckling her child, but may be sowing in it the seeds of some of these diseases.

It is interesting to note that asses and goats do not suffer from tuberculosis, and to bear in mind that the shrewd physicians of past days used to order asses' and goats' milk for persons threatened with consumption.

You will see how necessary it is that the milk-supply of large towns should be guarded from tuberculous contamination. No person suffering from phthisis should be employed about cows. Consumptive persons should especially be forbidden to engage in milking or in the handling

or distributing of milk. I do not like to contemplate the disgusting possibility of contamination of milk by sputa, but we cannot but admit that it might occur.

There is no need to consider at any length the contingency of the communication of tuberculous disease by means of meat. This usually is adequately provided against by the public slaughter-house and by the careful inspection of meat. Besides, we do not eat our meat raw, and cooking is fatal to bacilli.

The measures which are required for the prevention of consumption are at once suggested by what I have said as to the methods by which it is disseminated. If we could secure the destruction of all the expectoration of sufferers from phthisis and the freedom of milk from tubercle bacilli, we should very soon attain the end of the "National Association for the Prevention of Consumption." This ought to be quite possible, but before entering upon the way in which it can be effected, I must say a few words with regard to the old idea as to family proclivity and hereditary tendency to consumption. This was not a mere theoretical assumption ; it was based on observed facts, and nothing could be more foolish than to reject a conclusion founded on experience simply because the explanation was erroneous.

Constitutional Predisposition.

Although the immediate cause of consumption is the implantation of the tubercle bacillus, it is still perfectly true that consumption runs in certain families and that constitutional predisposition is an important factor in the production of the disease. But it is not actual disease which is transmitted from parent to child, nor will any degree of tendency in the constitution induce it. The hereditary constitutional predisposition is simply a liability to tuberculous disease on exposure to the germs, a vulnerability of the tissues producing a suitability of soil. Two people may be equally exposed to invasion by the bacilli, and one will develop phthisis, while the other will not, and we can usually tell beforehand which of the two will succumb and which resist. It may be mentioned that gout seems to reinforce the resistance to infection by tubercle, and, curiously enough, so does the anæmia to which young girls are subject. Besides, however, a constitutional susceptibility, another reason why consumption prevails in

certain families is that generation after generation lives under the same unfavourable conditions; as, for example, in dark, damp, ill-ventilated houses—in houses very often which actually harbour the bacilli left by previous cases.

As regards the preventive measures which must be adopted, I will first complete what I have already said on this point as to milk. To begin with, an absolute defence against the communication of tubercle bacilli by means of milk is to boil it. But some people, children especially, do not like boiled milk, others think it does not agree with them. But the desired end, the destruction of the bacilli, can be attained by exposure for a certain time to heat short of the boiling point, which does not affect its flavour—by sterilisation as it is called. This, however, demands a little time and trouble, and in how many households is the simple boiling of the milk too great a trouble? Fortunately, milk is now sterilised on a large scale at many of the more important dairies and by some progressive municipalities, and can be supplied in any quantity. As it keeps indefinitely while the bottles are closed it can also be sent to any distance. I tasted some a few weeks ago which was a month old, and as fresh and sweet as on the day it was milked.

Dairy and Farm Inspection.

But while we can kill the bacilli in milk we have a right to demand that milk shall be supplied to us which does not contain them. This opens up a large subject. An enormous proportion of the milch cows in this country and over most of the Continent are affected with tuberculosis, and they are potential sources of disease. Contrary to one's expectations, tuberculosis is much less prevalent among cows kept for dairy purposes in large towns than in the herds of dairy farms. This is due to the fact that cows which come under the purview of the medical officer of health are more frequently inspected and perhaps tested, and such as are diseased are killed off or quickly got rid of in some way. It is a melancholy thing that the greatest danger comes from fresh country milk. It is with great reluctance that I contemplate the imposition of a new burden on the distressed agriculturist, but pure milk we must have. Fortunately, an easy and certain test for the presence of tuberculous disease in the cow exists in the subcutaneous injection of tuberculin, and already in many herds

animals found to be affected are separated from the rest and gradually got rid of. In a few years, with precautions against the introduction of new animals affected with tuberculosis, the disease can be eradicated, and a very great degree of progress has been made in the last few years. This is a matter for rural and district councils and for landowners. It has, in fact, been taken up by far-sighted and public-spirited landlords. To insist on the universal testing of herds and the immediate slaughter of all affected animals would be ruinous to farmers unless there were compensation, and compensation would involve a demand for money which no Chancellor of the Exchequer could face. It would, besides, be a premium on carelessness and neglect of hygiene. Bad farmers would get rid of sickly beasts of their own making at the public expense. The extinction of tuberculosis in cattle must, I am afraid, be a gradual process, but in proportion as it is accomplished the farmer will be a gainer, because his tuberculous cows die early. I have had placed in my hands an appalling list of losses of cows year after year from this disease by an intelligent and industrious farmer. In the meantime we must boil or sterilise our milk, and sterilisation at home is an imperative duty when infants are being brought up by hand. Wholesale sterilisation at the dairy is open to abuse, and there is reason to fear that it may be so carried out as to impair the nutritive value of the milk.

The Spread of Consumption.

Prevention of the spread of consumption from persons suffering from the disease practically resolves itself into the destruction of the sputa. The sufferers themselves must be brought to understand this, and to realise that unless they adopt and faithfully carry out the necessary precautions they are a standing danger to their family and friends and to the public generally. The families of consumptive individuals must be impressed with the same idea, and the general public must defend itself by insisting on what is necessary for their safety. Convenient receptacles for expectoration have been devised, and one of these patients must carry about with them and conscientiously make use of. Every night and morning, or more frequently, the contents must be destroyed, if possible by burning, and the vessel must be well washed in boiling water and cleansed by some disinfectant, a little of the disinfectant fluid being left in it to receive the expectoration. If no fire is available it is, perhaps, permissible to throw the contents of the

spittoon down the water-closet, well mixed with a powerful disinfectant; never should they be thrown on an ashheap or out into the street or road or garden or field. Pocket-handkerchiefs should not be employed unless in the form of a square of soft paper, such as is used by the Japanese, which can be at once burnt. Some of my zealous friends advocate notification of consumption, as is done in cases of fever; but, I ask, what are you going to do with the patients when you have notified them? All the hospitals in the kingdom would not hold them, and I doubt whether any effectual inspection and enforcement of precautions would be practicable. The worry would be intolerable. And if we wait till the Legislature enforces compulsory notification, years will be lost.

One form of notification, however, is already in force—the death certificate—and action ought to be taken upon this. The room or rooms in which a consumptive patient has lived and died ought immediately to be thoroughly disinfected under the supervision of the medical officer of health In the case of those who have received public help during life this should be imperative, and others will, I am sure, see the necessity of it in the interest of other members of the family.

Preventive Measures.

But there are preventive measures to be taken on the part of those as yet in health, and these are of special importance in the case of those who belong to families in which there is an inherited susceptibility. The most effectual of these is to live, as far as possible, in fresh air day and night, summer and winter. The closely-fitting windows to which we attach such importance are a snare and a delusion. When we are sitting in a room with a fire, if air cannot make its way in by the window from the open air outside it will come in under the door from the passage and basement. Fear of a draught from a window open at the top leads to that most pernicious of draughts along the floor and about the ankles. Ventilation is of vital importance. But it is necessary by night as well as day. Everybody ought to sleep with the window open, and the bedroom ought to be as fresh in the morning as when it is entered at night. I believe—it is a mere conjecture, of course—that if we all slept with open windows the mortality from consumption would be reduced by one-half from this alone. There would be fewer colds and coughs, too. The construction of houses, again, is

a matter of great importance. There ought not to be a dark corner in a house, still less a dark passage. Sooner or later a dark passage or staircase will harbour germs, and, as everybody knows, they are the homes of dust. From this point of view some of the extensive flats and gigantic hotels which are now so numerous are a source of danger. In many of them the passages are tortuous, and dependent on gas or electricity for light. Efficient ventilation is impossible, and as an enemy of germs even the electric light is a poor substitute for the sun. I used to be greatly astonished to meet with tuberculous disease in families living in splendid country houses, with every advantage of climate, soil, and surroundings, and all the aids to health which wealth and education can command. At last I found that the secret was dark corridors and, in one remarkable case, a dim central hall. I was recently chatting with an eminent man of science and happened to allude to this conclusion of mine, upon which he told me that he was the sole survivor, I think, of eight brothers and sisters, and that he had lost almost as many uncles and aunts, all from phthisis, and that the family home was just such a large and imposing but dark and gloomy house as I had described.

I need scarcely mention the necessity of attention to the personal health. Excesses of all kinds diminish the constitutional resistance to tuberculous invasion. Alcohol in excess not only stupefies our brains, but our phagocytes, as the cells are called, which attack and destroy microbes.

Treatment of Consumptives.

So far, I have said nothing of the treatment of those suffering from consumption, and you might be disposed to think that this formed no part of my subject. But it does. Nothing can be more efficacious in preventing the spread of consumption than to cure those already affected by it, unless, indeed, you kill them off out of the way. Now a great deal more can be done to arrest and cure phthisis than was formerly supposed possible, by means of what is called, and what is in truth, the open-air treatment. We have been in the habit of sending phthisical patients to the shores of the Mediterranean in search of sun, to the mountain snows of Switzerland for a germ-free atmosphere, or on voyages to every part of the world for the healing virtues of sea air, perhaps to special institutions in Germany or the

Black Forest. Many returned better, some well, others perished miserably far from home and friends. At length we have become alive to the fact that the curative agent is not any particular air, but simply air. Thus the remedy for consumption lies ready to our hands. and instead of being attainable only by the favoured few is available for all. At Edinburgh, on the Norfolk coast. in Ireland, and elsewhere it has been shown that consumption can be treated successfully in practically all parts of our islands. This has revolutionised our ideas, and it has created new duties. If consumption is preventable it ought to be prevented—if it is curable it ought to be cured. What is needed for this end is the erection of additional suitable sanatoria, such as the one recently opened in the Caterham Valley, near London, and these ought to be provided within easy reach of every large town. Certain requirements must be fulfilled : there must be a dry soil, a southern exposure, protection from the east and north, absolute freedom from dust, and, if possible, from fog. The special desiderata are a maximum of sunshine and a minimum of wind and wet. The construction of these sanatoria and their internal arrangements will be simple. The one thing about them will be that it shall be impossible to close the windows of any room in them day or night. They need, indeed, be little more than sleeping-sheds ; but of course they would be made as cheerful and bright as possible, though pictures are almost inadmissible, as the frames harbour dust. The patient will spend the entire day in the open air, wet or fine, warm or cold. Movable shelters will be provided to shield him from cold winds and to protect him from rain. On no pretext will he sit indoors. The amount and kind of exercise he may take will be determined by his temperature and strength, and his life will be regulated in every respect. No great barrack-like building will be required. A sanatorium will usually consist of a number of small separate pavilions, which may be erected one after the other. (See article on TUBERCULOSIS in this work, and illustration on page 987.)

More Open-air Sanatoria.

An idea which finds favour is that at first these sanatoria should be self-supporting—should, in fact, be for paying patients. Some part of the disease could thus be dealt with before funds could be raised to provide for consumption among the poor. The association which I have the honour to

represent as chairman of the organising committee has for one of its objects the promotion of the erection of sanatoria in all parts of the country. It is to be hoped, and indeed confidently expected, that local branches will be formed for the purpose of ministering to local needs. Such branches will collect and expend their own funds and will erect sanatoria at any suitable spot in the neighbourhood, so that patients will not have to go far from home. The special function of the National Association for the Prevention of Consumption (of which his Majesty is patron, and in which the King takes so much personal interest) will be to co-ordinate the work of different branches, to stimulate public interest in the prevention of consumption, and to co-operate with all the agencies which have for their object the promotion of public health.

We ought to bring before county and district councils the question of milk, and aid health authorities to secure the construction of houses which shall not be standing invitations to disease, and the destruction and reconstruction of such as are, and to promote ventilation and cleanliness, Clergymen and ministers of religion, who see in the way of duty so much of the suffering and distress occasioned by consumption, will, we think, eagerly grasp the opportunity of informing themselves as to how the disease may best be combated and prevented, and of disseminating the information among families, thus reinforcing the efforts of the medical man. Schoolmasters and mistresses, again, can do much to teach children the lessons of health and self-preservation. I have only time to hint at a very few of the ways in which a great national association may bring about the prevention of a terrible national loss and the removal of a dark blot on the national good name. Much more can be done by a general, simultaneous, and united effort than by any number of isolated local efforts; and I hope that in the not remote future, when physicians are lecturing upon tuberculous affections, it will be on examples looked upon as rare and extraordinary cases and not, as at present, furnishing a very large part of their work.

THE SANITARY QUESTION-BOX

A HANDY GUIDE TO THE ESSENTIALS OF SANITATION AND VENTILATION IN THE HOME

EVERY householder is almost daily beset by problems in regard to health and comfort in the home, without knowing where to seek advice. Architects, builders, and plumbers lack either the practical or scientific knowledge required to deal with these matters, and serious results often follow from unsanitary conditions which might easily be cured if one only knew how. A defective basin-trap, a leaky drain, or a cracked rain-pipe may prostrate a whole family and prepare the way for an epidemic of typhoid or diphtheria.

To meet these widespread conditions we have had prepared by a sanitary engineer of long experience and national reputation the appended brief treatise on household sanitation as a ready means of education on the subject :—

SANITATION AND VENTILATION

What are the essentials of good ventilation ?

Opinions differ as to what constitutes good ventilation. It is not sufficient to dilute air which contains certain impurities, as one might add more water to a tumbler whose contents had been discoloured with a drop of ink ; but the whole volume of air in a room or hall must be replaced by a fresh supply. The usual standard is to require the atmosphere of a school or theatre to be changed every twenty minutes.

The objects of ventilation may be summed up as being : (1) to exclude dust of every sort ; (2) to properly regulate temperature and moisture ; and (3) to prevent the entrance of carbon dioxide and other poisonous gases derived from stoves, lamps, and furnaces.

What are the essentials of a sanitary dwelling ?

The three things of greatest importance in a dwelling are : (1) dryness of site, (2) sunlight, and (3) ventilation. Disease germs flourish in dark, damp, and close places. They are destroyed by light and free circulation of air. The sun should not be barred out with shutters or curtains, even

if it causes the carpets to fade. Again, keep the bedroom windows open, and remember Florence Nightingale's words: "The only air at night is night air," and it cannot harm anyone unless in a malarious region. If a house is musty and close it is not sanitary, and it should be thoroughly fumigated before occupancy.

What sanitary precautions should be taken in closing a house or apartment for the summer?

A house that is to be closed during the summer should have sheet-iron screens fitted into each open grate. This will prevent the soot sifting down into the room. All paraffin oil lamps should be thoroughly cleaned, the wicks taken out and burned, and the burners and fixtures boiled in a strong solution of soda, to be left absolutely clean. Nothing is more permeating and offensive than the smell from stale oil. Water-traps on plumbing fixtures should be filled with paraffin oil to prevent evaporation and the escape of sewer-gas. Before re-occupying the house in the autumn let the water run at all faucets to replenish the seal of traps, and ventilate all living-rooms thoroughly.

Which is to be preferred on sanitary grounds, an old country house, well built and substantial, or a new, up-to-date average building?

An old house is apt to be damp and out of repair. In such buildings one should beware of disused cesspools, old wall-papers, and damp cellars, and thoroughly fumigate and whitewash as a precaution. If the frame of an old house is solid it may be enlarged to advantage; alterations, however, are usually costly. New buildings shrink as the woodwork dries, and cracks are caused by settling. Tons of water are used in making plaster, and this water must evaporate before the building is dry. The old proverb is wise: "The first year for your enemies, the second for your friends, the third for yourself."

The average dwelling to-day is built to sell, usually by cheap and oftentimes unscrupulous building contractors. It is a choice of evils at best.

Are high-ceiled living-rooms desirable?

It is a fallacy that high rooms constitute healthful rooms. High rooms necessitate high staircases, high doors and windows, and volumes of cold air. Spaciousness and ample superficial area are essential qualities in a good room, the effect of which excessive height tends to limit and destroy. To make rooms healthful you need circulation of air, not space for foul

air to collect in. An eight-foot room may be better ventilated and more comfortable to live in than a room twelve or fifteen feet high, and it is certainly more easily lighted and warmed.

What is the best disinfectant for a house-drain ?

If any odour is noticed from the house-drain, it should be disinfected by pouring in a pound of copperas dissolved in a pail of boiling water, say, twice a week. Fresh air, however, is the best disinfectant, and but little complaint of bad odours is made even from open filter-beds which receive the drainage of large communities. It is stagnant, soapy filth, festering within drains and sewers, which is most offensive, or the reeking contents of cesspools.

Is it sanitary to bury garbage in a shallow hole in a back garden surrounded by inhabited dwellings ?

Decidedly not, and the health authorities should prevent it. If covered thoroughly with soil it might be excusable, but not otherwise.

THE BEDROOM

What is a simple method for ventilating a bedroom ?

This may be accomplished in several ways, as by raising the lower sash a few inches and putting a strip of wood under it, or a better plan is that which consists in tacking a strip of cloth or heavy paper, ten or twelve inches in width, across the lower part of the window. In this way the lowest sash can be raised almost as high as the top of the screen, and no draught will be felt. Another method consists of a piece of wood which shall fit under the lower sash when raised, and into which two or more elbows are inserted. These elbows are usually from five to six inches in diameter, and bent upward, thus directing the current of air upward. The openings in the elbows should be covered with fine wire screens to exclude dust.

How can the fresh-air supply for a bedroom be regulated ?

Drive a nail at the top of the lower sash of the window, and screw a pulley-wheel to the window-sill. Fasten a cord to the nail, which passes down through the pulley and thence to the bed. A light tug on the cord, and down slides the sash. To raise the sash another cord is passed through a pulley which is screwed to the top of the window-frame, and also attached to the top of the lower sash ; by means of this the sash is raised.

My family physician says a bed should stand out from the wall several inches. Is this desirable ?

Yes ; so as to insure a thorough circulation of air and to get away from the wall itself. Air stagnates on the inner side of a bed, as one's sense of smell demonstrates. We really should sleep out of doors, or in a draught to get pure "lung food" at night.

In what direction should a sleeping-room face if occupied by an invalid ?

An easterly room is too light in the morning ; a westerly one is hot in summer, but gives pleasant sunset views. A southerly outlook is best on the whole, as the prevalent breezes in hot weather are from the south-west.

What is the most sanitary material for bedsteads ?

Enamelled iron is steadily replacing wood as a material for bedsteads. It is light, pleasing to the eye, easy to handle and to keep free from insects, and therefore sanitary in every respect. Enamelled iron is less troublesome to keep neat than brass, which too often requires frequent polishing. Two single beds are better than one double one.

How can one avoid draughts from open windows in a child's nursery ?

Place a chair or towel-rack covered with mosquito-netting between the crib and the window to break the force of the wind. A wire screen in the window will serve the same purpose ; or, if there are blinds inside or out, turn the slats at an angle so as to deflect the air upward, and that will lessen any draught.

Are fixed wash-basins allowable in sleeping-rooms ?

As long as the plumbing has been done by a competent mechanic and afterward *tested* with the smoke or peppermint test (which see), there is no cause for objection, but otherwise they are not desirable. They should stand near a window, if possible, so as to secure sunlight and air, and the basin should be well trapped and properly ventilated.

Should a bed-chamber be occupied during the day as a sewing or sitting room ?

No ; a separate room should be provided for such purposes, and the chamber well aired by leaving the window open through the day.

Should bedsteads be set in alcoves or recesses where there are no windows and where the direct rays of the sun do not penetrate?

It would be far better if the reverse were the case. Bedding needs sunning and airing, and if there is no window handy it will not receive proper attention. A bed that has been occupied for eight or nine hours needs more than half an hour's ventilation.

Should plants be kept in sleeping-rooms?

No, they should not. Florists often suffer from malaria contracted in greenhouses, and flower-pots and window-boxes are excellent places for germs to develop.

Are basement bedrooms in a summer cottage unsanitary, if they are constructed under a verandah with a passage in the rear?

Many cottages have bedrooms arranged in this way, but it is healthier to sleep on upper floors.

Is there any means by which a bedroom in a set of flats in which a steam-pipe passes through to the upper floors can be made cool and comfortable on mild days? Cannot the pipe be coated or covered to retain the heat?

Yes; a number of materials are made especially for this purpose, as asbestos, etc. An opening with a movable cover should be left in the packing so as to let the heat into the room in cold weather.

How can the temperature of furnace air in a bedroom be modified when it is too dry for comfort yet when the register has to be left partly open at night in severe weather?

Hang a Turkish towel on a rod or wire in front of the register, and let the lower ends rest in a shallow pan of water. This will keep the towel continually wet by capillary attraction. The quantity of water that is sucked up and evaporated in a day by such an arrangement is surprising.

Many persons close the metal fireplace register to exclude soot from bedrooms, but should they not be left open for ventilation?

Most decidedly, as the current of air through such openings will change the air at short intervals.

Are carpets desirable in bedrooms?

Not as a general rule. Bare floors, with rugs that can be shaken and sunned out of doors, are much more sanitary. An experienced

housekeeper favours having carpets in bedrooms, because with bare floors dust always shows under the beds. But this proves the necessity of not permitting dust to collect where it cannot be seen and readily swept up. Dirt is simply matter out of place.

To keep a sick-room clean where the carpeted floor cannot be swept, a professional nurse will go over the carpet with a cloth wrung out of warm water with which a little ammonia has been mixed. Upholstered furniture is treated in the same way.

Is matting desirable as a floor-covering in chambers ?

Not unless it can be frequently replaced, as it is easily frayed in moving bedsteads, etc., and it cannot be kept as scrupulously clean as a bare floor, with rugs that can be aired and shaken.

Should an adult occupy the same bed as a growing child in an unventilated room with a night-lamp kept burning all the time ?

By no means. Put the lamp in the hall, or in another room, and have separate beds for each person, whether old or young.

Should domestic servants be required to sleep together ?

No ; separate beds, or, still better, separate sleeping-rooms should be the rule. The forcing of two strangers to share a small, ill-ventilated room is little short of a barbarism in these days of the worship of individuality, if it can possibly be avoided. Again, so many domestics sleep with their windows shut at night that they should not be crowded together.

What material should be used to clean a baby's rubber sheet ?

Use a flannel cloth dipped in paraffin oil. It removes every bit of dirt and every stain. An airing quickly dispels the odour of the paraffin.

Is it hygienic to hang up clothing that has just been taken off, after a walk or a dance, and perhaps damp with perspiration, without airing ?

It is not. Yet many women seem to regard as one of the paramount virtues that every garment must be put carefully away as soon as removed.

The mother who teaches her child to fold each garment carefully and pile one on another in a chair is inculcating order, but disregarding health. Order may be heaven's first law, but it is equally true that "cleanliness is next to godliness."

Garments that have been turned inside out and exposed in an empty room will be found far fresher and more hygienic, especially if kept there

for at least twelve hours before putting them in their places. Have a window open in the room if possible. It is well to hang underwear taken off at night over chairs before the open window. It is good for the clothing and better for the wearer. A tight-closed cupboard filled with clothing is not sanitary. It should have wire panels in the door and the garments should not touch one another, so that the air can circulate freely around them.

THE KITCHEN

What are the essentials of a model kitchen from the hygienic point of view?

A sanitary kitchen should be above ground and, if possible, on the same level with the dining-room and drawing-room. A basement kitchen is an abomination, and is almost sure to be unsanitary. Washing and cooking should be wholly separate. Wash-tubs filled with soiled clothing do not belong in the kitchen. A sitting-room also should be provided for the use of domestics after their work is over or between meals, especially in warm weather. Yet how few dwellings have any such provision! Half the discontent of servants is due to their uncomfortable surroundings.

The room should be lofty. A low-ceiled kitchen may look picturesque, but usually it is either hot and stuffy or draughty. Where cooking is going on, and so many odours are created, there should be plenty of air space, and the windows should reach well up so as to ventilate the upper stratum of air.

Some persons consider a square kitchen the best shape. Others prefer a long room with the fixtures ranged on either side. Compactness is an advantage, and saves many steps. Handiness is a great help, and the serving-table, range, sink, and dresser should be near to one another. Entrance from outdoors should be by a porch with double doors in winter, to avoid draughts. The same porch will prove most convenient in summer for all light work and as a sitting-place on warm afternoons or evenings. The walls should be hard finished and the floors bare, so that scrupulous cleanliness can be maintained. Have the woodwork finished so as to require oiling only, and give the walls a light tint. Tiling is good if one can afford it, especially around sinks, and it will prevent insects nesting behind the woodwork.

A hood for the range to carry off cooking odours will be found a good investment. A range standing out from the wall, with rounded corners, is preferable to one set in, and will consume less fuel. A gas- or oil-stove is a great convenience, and saves fuel and heat. A rail upon which to

hang cooking-utensils will prevent the placing of them in dark cupboards or corners, and the mistress can see at a glance whether they are kept clean. This is one of the most important fixtures in the kitchen.

Can a kitchen be ventilated into the range flue without affecting the draught?

Not very well, and it is better to provide a special flue for ventilation.

What points should be considered in choosing a kitchen range?

As a matter of fact, the flue construction of all modern ranges is identically the same, the only difference being in the manipulation of the grates and outside ornamentation. In good houses, where there is public gas from a municipal plant or from a private lighting-plant, use the French pattern combination range, with two baking ovens heated from one coal fire in the centre of the ovens; gas-range sections mounted on either end; and gas-baking ovens and broiler. The range can be furnished to burn either coal or wood. A separate ventilating-flue should be built close to the smoke-flue, so that it will be properly heated and create an upward draught.

Are gas-stoves to be considered sanitary?

Decidedly yes. At first too poor material was used in their construction; careless joints were made so that leaks were almost the rule—children became sickly, silver tarnished, plants died, and the evils were worse than the comfort—but most of the difficulties have been removed since.

Do not set a gas-stove too near a window, for someone may open the window, and in your absence a strong puff of wind may blow out the flame, leaving the gas to escape, though the odour would soon attract attention. This is a wasteful possibility that should be guarded against.

In preparing certain foods which require long and slow cooking by gas, there is sometimes danger that the lights may go out. But with a really good gas-range, even a pin-point of flame will not blow out unless there should be a draught.

Where the oven has no protecting case, much heat is wasted; but this does not count for much as to cost. An entire dinner and breakfast for a family of six has been cooked at one time at an outlay of less than twopence. Earthen crocks were used, as they retain heat best.

Gas-stoves are certainly economical, and think of the saving in bother and dirt and in the handling of ashes. Strike a match, and your kettle

starts to boil. Turn a valve, and the fire is out. No waste, no delay, no excessive heat in the kitchen. Everything compact and comfortable.

How can minute leaks in gas-pipes be closed temporarily while waiting for a workman to come and fix them?

A little soap rubbed over a pin-hole opening will close it effec ually.

How can one guard against leaks in rubber-tubing from gas-fixtures?

Blow into the tube occasionally, with the finger over the other end, to see if it is air-tight.

What are the comparative advantages and cost of gas and electricity for cooking?

Electricity for cooking usually costs nearly twice as much as gas. Heating water by electricity is expensive, and other means should be provided for this purpose in addition to the cooking arrangements. The first cost of the electric apparatus is high owing to the small demand.

The advantages claimed are: (1) it is more economical in point of heat utilised than any other appliances; (2) cleanliness and general convenience; (3) no waste of food materials; (4) cooking is reduced to a science, and absolutely uniform results can be obtained, while a given temperature can be maintained within a few degrees. Explosions are impossible, and the risk of fire is reduced to a minimum.

How can a kitchen range be kept free from rust caused by spattering grease and by dishes boiling over?

Provide an asbestos cover for the top of the range with round openings cut to fit the holes. Such a cover is not expensive, and it is a great saving of labour and annoyance.

How can one clean zinc placed around or under stoves when it has become apparently hopelessly stained?

Soap, water, and scouring may fail to improve it, but a solution of sulphuric acid and water, applied with a small brush, will remove the stains and leave the zinc looking as fresh as new. It must, however, be well rinsed, otherwise the acid may eat holes in the zinc.

What is the best material for kitchen utensils?

Cast iron is easily broken and does not give a very smooth surface. Steel takes a high polish, does not break readily, and, in the end, is more economical. Iron and steel improve with age, and are suitable for

frying-pans, etc. They should not be used for cooking fruits or any food into which acids enter. Meats, cereals, and all starchy foods may be cooked in them.

Good aluminium ware, although high-priced, is economical in the end. It will stand a very high temperature, takes a smooth polish, and is light and beautiful to work with. Ordinary acids do not affect it, but caustic soaps, sodas, etc., should not be used on aluminium.

All enamelled ware is either cast or pressed and then coated with a preparation which is then fused at a high temperature. The slightest bend will cause the enamel to crack and chip off. These bits of enamel are hard and sharp, and if they get into the food may cause trouble. When purchasing, examine each piece carefully to see that there are no cracked or broken places in the enamel. Never use a sharp instrument in scraping. A good quality of enamelled ware is a good investment.

Tinware is suitable for holding lard and to knead dough or wash dishes in. Fruit should not be cooked in tin, as it spoils the colour and flavour. Tin melts at 551° F. Tin utensils should never be used for frying or where the temperature is high.

Are closed cupboards for china and cooking - utensils desirable in kitchens ?

Closed cupboards are inconvenient, accumulate dust, and invite mould. On the Continent, as in this country, pots, kettles, and frying-pans are hung along the walls. In hotels, as on ships and steamers, they are suspended from the ceiling. If kept clean the dust will do no harm and the air will purify them. Dust abounds everywhere, and no closed cupboard is free from it. If utensils are kept in full view, their condition can be seen by the mistress of the house far better than if tucked away in dark, dusty corners.

What is the best material for a kitchen sink ?

Slate and sandstone sinks are hard to keep water-tight. Sandstone is soft, and consequently easily chipped ; the roughness made by constant use catches grease and dirt and makes the sink foul. Slate readily scales off under the alternate action of hot and cold water. Both slate and sandstone sinks are also less convenient than glazed earthenware sinks, which are easily kept clean, and with ordinary care do not chip. Heavy porcelain sinks of good make will not "craze" or flake off, and pay best in the end.

How should a kitchen sink be fitted up ?

For a large house the kitchen sink should measure at least forty-two inches, and be supplied with hot and cold water through large-size compression faucets of polished brass with china indexed handles, the waste passing off through a two-inch brass trap. It should have an open strainer, and be furnished with a grooved drainboard on either side. A separate sink for the washing of vegetables is desirable.

What is a simple and inexpensive way to protect the back of a kitchen sink from splashing, which rots the woodwork ?

Measure the sink from end to end, and get a board of that length and about a foot wide. Cover it smoothly with oilcloth, tacking the raw edges on the back. Put a screw-eye about six inches from each end ; hang it so that the lower edge will come over the back of the sink. Then any water will run off into the sink. This will keep it dry, and when the oilcloth is soiled it can be cleansed with paraffin oil.

How can a kitchen sink be kept free from scraps of food ?

An experienced housekeeper suggests the following labour-saver to accomplish this object, if one has no better sink-basket : With four small boards make a frame six inches square, on one side of which tack a piece of old wire screen and set it over the drain of the sink. Then all that need be done is to pour all water into it, then lift it, and, inverting it over the dustbin, give it a few sharp knocks, when the refuse drops and the frame-sieve is clean and ready to be put in its place. The wire is easily renewed when rusted, the sink does not require scrubbing, and there are no bits of food to be picked out.

How can kitchen waste-pipes be kept free from grease ?

If the kitchen waste-pipe has little fall, or if it is carried through a cold cellar or near a window not well protected from the weather or with cracked or broken panes of glass, or if it passes near cracks in the furnace air-box so that cold air strikes against it, the grease will " chill " and choke the pipe. In some cases it would pay to carry the kitchen waste-pipe in a direct line to the trap on the main drain with all possible fall, so that it would empty at that point and thus have less chance of choking, particularly as the flow through a small pipe is more rapid and self-cleansing than through a large one.

Is it proper to provide one trap for a kitchen sink and a bath?

Yes, such an arrangement is usually permitted by sanitary authorities, though a separate trap is desirable for every fixture.

How can soap and grease be removed from a basin or sink trap?

Use potash (lye) dissolved in boiling water, and let it stand in the trap overnight.

What is the best covering for a kitchen floor?

Oilcloth is cold, and causes rheumatism; linoleum is better as a floor-covering, but a cement floor is preferable, with strips of carpet or cheaply woven rugs placed where warmth to the feet might be necessary. Tiling is good, especially around the walls, instead of wooden strips, which afford a nesting-place for insects.

How can smoke-stains be removed from walls and ceilings?

Stale bread is simple and effective for cleaning smoke-stains on walls and ceilings. Rub the soiled places with bread, changing as fast as the bread becomes dirty. If this treatment does not remove all the stains, cover the surface with a thin paste of fullers' earth and water. Brush this off at the end of forty-eight hours. Possibly a second treatment may be necessary.

What will remove discolorations from enamelled iron or earthenware sinks and exterminate cockroaches?

Apply paraffin oil with a soft cloth, and both stains and insects will disappear.

THE WATER-SUPPLY

How much water is needed for an ordinary household?

For personal use, from twenty to twenty-five gallons per person should prove to be ample per day: this comprises water for drinking and cooking, for washing clothes, house and kitchen utensils, personal ablutions and bathing; but, taking into account other requirements, as on the farm or in country houses, we require at least sixty gallons per head per day. To provide water for the horses, cows, sheep, for carriage and motor washing, for the garden, for fountains, etc., and to keep a suitable reserve in case of fire, the supply should not be less than 150 gallons

per person a day. It is a universal experience that as soon as a water supply is introduced into a community it is used more lavishly, but also more recklessly and regardless of waste.

Are garden water-meters a necessity ?

A careful study of the water problem in over a hundred towns shows that the average daily consumption of water is just double what it should be, and that as soon as water-meters are installed the consumption decreases rapidly—in one case from 153 to 62 gallons.

Are ordinary springs always to be depended on as a source of pure water ?

It is a popular fallacy that all spring water is absolutely pure and healthful. In some cases, spring water may be nothing but contaminated ground water. Land springs in uncultivated and uninhabited regions, particularly in the mountains, yield a good and pure supply. But it is always advisable, when tapping a spring for water-supply, to study its probable source, and to carefully inspect its immediate surroundings. The spring should be protected by constructing a small basin, or reservoir, and by building a shed over this. The basin will also serve to store the night-flow of the spring.

Deep-spring water is less apt to be polluted than water from surface or land springs, for it has a chance in its flow through the veins of the earth to become filtered. Land springs always require careful watching, particularly in inhabited regions, to prevent surface contamination.

Water from deep springs is rain-water fallen on the surface of a porous stratum on a high level, and which passes under an impermeable stratum, and thus, being under pressure, rises again where an opening is encountered in the impervious stratum ; these latter springs are really artesian in character.

Some surface springs run dry in midsummer. A deep spring maintains an almost uniform temperature all the year round.

Can the supply of water from a well be increased by enlarging it ?

Yes, if it is of ordinary depth, where the yield is usually in proportion to the diameter. With deep wells it is different, and a two-foot well yields only fifteen per cent. more water than a three-inch pipe well. No general rule can be given as to the exact amount of water to be obtained from wells without knowing the local conditions.

Can you recommend a good filter for household use?

Various materials are used, among them being sand, sponge, flannel, cotton, animal charcoal, and spongy iron.

Domestic filters should act not only as strainers by removing suspended impurities, but they ought also to act chemically by oxidising a part or all of the dissolved organic matter.

Nothing is more erroneous than the supposition that a filter, once started, will continue to act, without further attention, for ever. Whatever the filtering material may be, it should be frequently cleaned and aerated, and renewed from time to time. It must, therefore, always be easily accessible.

Most small filters, to be screwed to faucets on the supply-pipe, are made reversible, and if this operation is regularly performed they work quite well, although their action is of necessity largely mechanical. Larger filters connected by means of a hose or a pipe with the pressure supply answer well, provided they have an arrangement for reversing periodically the direction of the filtering current. Filters are also placed in cisterns or at the end of the suction-pipe in wells or cisterns. A good plan is to build into the cistern a partition wall, establishing a small chamber in which the suction-pipe is placed. The dividing wall is built with courses of brick, some of which, being laid dry, act as strainers.

This arrangement also demands periodical cleaning. It is surprising how many householders imagine that a filter can be used continuously without cleaning. In a short time the impurities that are held back by the filtering substance become a perfect hotbed for developing germs and a positive source of danger.

THE CELLAR

What are the essentials of a sanitary cellar?

Every really up-to-date dwelling should have a cellar to contain the heating apparatus, store fuel, and for comfort's sake. The cellar should have windows on opposite sides which can be opened in all kinds of weather for ventilation. Coal-bins should not be so high as to obstruct free circulation of air. Cellar walls should be whitewashed every spring and autumn, and the ceiling should be plastered, and wall openings for the passage of soil- and waste-pipes closed with cement to prevent cellar air from rising into living-rooms. The floor should be covered with six inches of broken stone, over which should be laid three inches of Portland cement. This will prevent "sweating," which would result if the cement were laid directly upon the cold ground. If there is a cellar drain, this should not

connect with the house drain unless there is an intercepting trap fed from some certain source, as the waste-pipe from a refrigerator.

What are the signs of a damp cellar?

The signs of a damp cellar are fivefold: (1) rust on exposed metal pipes and flues; (2) broken plaster and "buckling" lath; (3) dry rot in floor beams; (4) fungus growth on walls; and (5) spots of mildew and moisture between the cracks of the flooring, with a musty odour and general sense of closeness. In addition, look for wet dirt in the spaces of the cobble-stone flooring, or flags, and rotting of ends of wood in posts that support the ceiling.

What is the cause of sweating cellars?

One notices how moisture condenses on the outside of an ice-jug in hot weather. The same phenomenon takes place in a stone house or cellar. When the temperature is at 60° F., air that has been exposed to water or to a moist surface contains 5·77 grains of water per cubic foot, and at a temperature of 80°, under like conditions, it holds 10·98 grains per foot. If the walls of a house have been cooled by a northerly wind for a few days, and there comes a warm south wind laden with moisture, as often happens in summer, the air is chilled below the dew-point when it comes in contact with the cold surface of stone, and a deposit of water appears on the surface. Brick walls are more readily warmed, as they are not generally so thick as stone.

Dampness is caused in much the same way in new houses built of other materials. A large amount of water is used in making plaster for the walls, and this takes a long time to dry out. When a new house is occupied and fires are lighted, the warm air is condensed against the cold walls, and the inmates complain of colds and coughs.

How often should a cellar be whitewashed?

At least once a year, but every autumn and spring would be better.

How should a broken drain in a cellar be disinfected?

Remove all saturated soil and replace with ashes or clean earth. Disinfect the surroundings with copperas dissolved in hot water, in the proportion of a pound to a pail.

Can the supply of fresh air for a hot-air furnace be taken from a clean cellar or from a vestibule that is well ventilated?

The fresh-air supply for the furnace should never be taken from a cellar, no matter how clean it may seem; nor should it be taken from an

entrance hall, as is often done in churches to save fuel. Only outdoor air will serve for such purposes.

Is it sanitary to have a furnace register set in the floor where dust collects ?

No ; such dust is inflammable, and also a breeding-place for germs of all sorts. If registers are in the floor, take them out at least once a month, have them thoroughly cleaned and the pipe wiped out with a damp cloth as far down as possible. When the room is being swept, or the furnace cleared out, place a damp cloth over your registers.

Can flooding of cellars by tidal pressure through drains and sewers be prevented ? Are there not traps made with valves for this purpose ?

Untrapped sewers and drains often overflow from tidal pressure in the lower levels of towns, when gorged during heavy rainstorms, or when the end of the sewer is exposed to gales of wind. Cellars are frequently flooded from this cause, either through defective joints or through the traps on servants' water-closets or sinks. This defect can be remedied by placing a back-pressure trap on the house drain with a valve like a swinging gate which shuts automatically.

What is the difference between a leak in a water-pipe in a cellar and the " drip " from condensed moisture ?

Dripping pipes due to condensed moisture are often mistaken for leaks in supply-pipes ; but the condensed air forms in small continuous drops over the surface of a cold-water pipe and is quite different from a steady leak.

THE LAUNDRY

What are the essentials of a model laundry ?

The laundry should have ample space for washing and ironing, a separate stove and boiler if the work is large, and a cupboard for irons, stands, boilers, ironing-boards, wax, clothes-pins, clothes-horses, etc. The wash-tubs should have covers raised on pegs to allow the air to circulate within. A woven cotton clothes-line is preferable to wire. If the tubs are set at all high a board-step should be supplied for the laundress to stand on. All women are not of the same height, and stooping is fatiguing. A worn-out goatskin rug lined with cocoa matting can be utilised to advantage in front of the wash-tubs on cold days. Wash-tubs should never be placed in kitchens.

Please explain why the walls of laundries and bathrooms are affected by the steam from bath and wash tubs ?

The probable reason is that the material used in their construction was inferior in quality. Such walls should be hard finished, so as to be impervious to vapours of every kind.

What is a good way to remove cooking odours and steam, caused by boiling clothes, from a country house ?

Kitchens and laundries should be detached wherever it is possible, and they should have swinging doors to exclude cooking smells from the living-rooms. A ventilating hood over the range will prove of great utility in carrying off odours, but it should be high enough not to reflect heat upon the cook's head, and it should connect into a separate flue in the chimney or it will affect the draught of the range.

A laundry should be well ventilated. So much heat and steaming vapour make washerwomen have tender throats, and they easily take cold.

MALARIA AND CONTAGIOUS DISEASES

Why are some suburbs and urban districts liable to be rather malarious ?

The suburbs of some large towns are subject to fevers and malaria on account of the extent of undrained ponds and surface-water. Just as fast as sewers are provided and these local pockets are drained of moisture, as well as street pavements are extended, malarial illness disappears. The introduction of a public water-supply is also an important factor, as many urban districts are dependent on wells which are liable to be polluted from cesspools, cemeteries, stables, etc.

What agencies brought about the removal of malaria in recent years ?

The development of the manufacture of glazed earthenware tiles, which made surface drainage of farm lands possible on a large scale ; and, also, the sewerage of towns and dwellings at a small expense marked an era in sanitary progress. The fever-stricken English fens became healthful as soon as they were drained, while the neglect of the old methods for carrying off surface-water from the Campagna in Italy revived the fatal Roman fevers. A pure soil, pure air, and pure water have ever been agencies for maintaining health.

Is there any serious danger from having a case of scarlet fever in an adjoining detached house where the bedrooms are only a few feet apart and the inmates insist on opening the window on that side?

We hardly think there is cause for anxiety. With the modern treatment of scarlet fever, the skin is kept soft, and the scales, which are the sole source of contagion, are not allowed to dry and float about the air. Ventilate your own house thoroughly and stay out of doors as much as possible, and no harm should follow.

How can one best avoid infection when exposed to it in hospitals, tenements, or dispensaries?

Never sit down to rest while you are in an infected house; never relax your system so that it will absorb disease. Change your clothing as often as possible—the oftener the better—and wash your hands frequently. Too much stress cannot be laid on this cleansing of the hands, cleansing them as carefully as for a surgical operation. The chairs and tables, door-handles, your own clothing, hold germs that are baneful. You touch these things, and, unless rid of the contamination speedily, your body is in danger. In certain hospitals abroad the boys and girls who wait on lepers go about the building with small walking-sticks in their hands—these they use dexterously and make do the duty of hands as much as possible. They push open the doors with these sticks, pick up articles with them, and otherwise make them useful.

PLUMBING AND DRAINS

Is there any way for a layman to judge the quality of the plumbing of a house when seeking to rent or buy a home?

The quality of plumbing may usually be judged by its general appearance. If what is seen is carelessly done, it may be inferred that the hidden parts will probably be worse. If the pipes sag where they should be straight; if the joints are but half filled with lead, or covered with putty; if wiped joints are "scamped" to save solder—all these are the earmarks of a careless workman. One might almost distinguish poor work by its feel in the dark. Again, when you see patches on waste-pipes covered with sheet lead and fastened with wire or string or with putty, it indicates that something is wrong, or it would not be necessary to cut openings to clear the pipes of grease or other obstructions. In such cases the pipes usually have not enough fall, or they are exposed to cold, and the grease chills inside, which would not happen if they were properly laid.

How can one make a "peppermint" test of the plumbing of a house?

Pour four ounces of oil of peppermint into the soil pipe at its mouth above the roof, if it is accessible, or into the basin or water-closet nearest the roof. Pour in immediately after a pail of hot water. If the odour of peppermint is perceived at any lower fixture, it is an indication that there is an opening in some pipe through which foul air may escape. The peppermint should be kept outside the house until needed, and the person who pours it in should remain on the roof, or in the room with closed doors, until the examination of the fixtures below has been made by an assistant, otherwise the odour will come from the bottle, or the clothing of the person, and spoil the test.

What is a plumber's trap?

A trap is a piece of bent pipe shaped like the letter S, or P, which holds about a teacupful of water. It allows water to flow out, but keeps sewer-gas from backing up into the pipe. Such appliances have long been used in chemical laboratories and in gasworks. Unless constantly used the water will evaporate. A trap must not be too large or its contents will evolve bad odours, and it must be smooth and self-cleansing. Lastly, it should be placed close to the fixture, so as to leave the least possible space above the trap to get foul.

There are a vast number of traps in use, but the S-trap is the only perfect kind. In certain cases what are called bottle traps are used, but these soon choke with black, slimy grease, and become miniature cess-pools.

What is the best material for house drains—cast-iron or earthenware (tile)?

Whether the house drain should be of cast iron or earthenware is an open question. It is preferable to have a cast-iron drain carried with a good fall (one in sixty) along the side-wall, rather than to have an underground tile pipe which is liable to crack or be damaged by roots of trees, rats, etc. In good practice only iron pipe is permitted within doors, and tile pipe outside the building. The iron pipe should be carried three feet outside the foundation walls in order to avoid any risk of breakage from the building settling. The laying of underground drains is usually entrusted to unskilled labourers; yet it should be carefully done under competent supervision. If tile pipe is chosen for economy's sake, a ditch should be dug two feet wide so as to give ample room for action; the bottom should be beaten hard, and have a slope of one foot in sixty, with

a slot to receive each hub. The cement should fill the entire circle of the hub, and after laying each length of pipe the interior should be scraped clean with a piece of bamboo having a swab at one end to remove all obstructions.

Please explain the action of trap siphonage.

When two basins or other fixtures are emptied simultaneously, or when the upper one is discharged, the rapid flow of water tends to create a vacuum, and siphon the upper basin trap unless it is very close to the waste-pipe. It is also liable to force foul air through the lower trap and afterward to draw the seal in the same way. The remedy is to carry a vent-pipe from the crown of the vent-trap direct to the roof.

Should there be a trap in the house drain to intercept the cesspool or sewer ?

Even if house drains are of good material and properly connected, there is still risk of the traps or fixtures losing their seal by evaporation or siphonage, so as to permit the entrance of sewer-gas into living-rooms. A thorough circulation of air is therefore necessary throughout the entire drainage system, so that in case of a leak or accident only diluted foul air can escape. To secure such ventilation a running trap is placed upon the main drain between the house and the sewer or cesspool, with a fresh-air inlet from just inside the trap, extended to the ground-level and ending in an open box covered by an iron grating, which should be kept free from dirt. The air entering at this opening will circulate through the whole drainage and pass out at the roof so as to ventilate every pipe and drain.

What is the necessity for trap ventilation ?

It is contended that trap-vents are costly, liable to choke with grease, and unnecessary if fixtures are located close to a soil-pipe. In such cases they may be dispensed with ; but under ordinary circumstances, where fixtures must be located in all parts of a building, such vents are indispensable.

How should a well be protected from surface pollution ?

By having a cement coping or one of heavy tile pipe extending some distance down into the well.

Can a cesspool be properly ventilated with one opening ?

By no means. Two openings are necessary, one to let in fresh air and the other to exhaust the foul air.

How near should a cesspool be located to a well?

It should not be any closer than one hundred feet for safety; the farther away the better.

How should a basin-trap be cleaned of accumulation?

Unscrew the little cap at the bottom of the basin-trap and remove the black fœtid mud within. If you have ever laboriously picked out the hair, lint, and burnt matches from the strainer, you can realise the need of constant watching and cleansing of these miniature cesspools.

What is the effect of sewer-gas upon unventilated lead soil-pipes?

I have a number of samples of the effects of sewer-gas in corroding lead pipes; one piece is so honeycombed as barely to hold together. Some of the holes are as large as a half-crown piece, and the edges are discoloured with the salts of lead. I have found these specimens of great use in silencing sceptical persons who talk about sewer-gas being a "humbug" and a "scare."

Is there any way to thaw frozen ground to get at plumbing pipes except by building a fire?

Unslaked lime is suggested for thawing frozen ground. The lime is first spread at the spot to be excavated, and covered with a layer of snow, if available; a second layer of lime is then added and snow placed over it. In twelve hours or more the ground beneath will be soft. If the frost is very deep, a greater number of the alternate layers will be required. In the absence of snow, water must be used to slake the lime, and the whole covered with sand to prevent loss of heat.

What are the advantages of small pipe sewers over large brick ones?

(1) Greater cheapness; (2) better flushing facilities, as the flow of water scours them clean and prevents deposits of silt; (3) fewer manholes are needed for ventilation, while there is less digging, less material, and less labour. If a great deal of surface-water has to be cared for, there is risk of flooding during heavy storms and of backing up into cellars; but the advantages, in most cases, are greater than the drawbacks. Of course, in a large town, with many factories, and a dense population consuming much water, the sewers must be proportionately large; but for residential suburban communities, the small sewers can be laid with little outlay, and should be made compulsory wherever there is a public water-supply.

Is it desirable to train vines up rain-water pipes owing to the risk of the weight of the vines pulling the joints apart?

No; but this is not an uncommon occurrence, especially with light-weight rain-pipes. If the fall pipe connection with the house drain is not trapped, sewer-gas may escape through such openings close to bedroom windows, or it may eat through the pipes and honeycomb them. On this account heavy spiral pipe is preferable, with a deep trap at the foot which will not dry out readily. This trap should connect with the outside drain, so that during droughts, when the place is washed down with a hose, the trap-seal will be fed and the water will not evaporate.

CLOSETS, ETC.

Is a short-hopper water-closet with the trap above the floor to be recommended for indoor use?

The short-hopper, with its trap above the floor, has the advantage of exposing less surface to contamination, but it is apt to become foul from matter adhering to the angles and bends where they cannot be reached and removed. While well adapted for business offices and other public places, they are not desirable for domestic use. They cannot be used out of doors on account of the risk of frost.

Can you recommend a low-priced water-closet suitable for a summer cottage?

An enamelled iron short-hopper is well suited for such places if located in a detached room or building.

How can I arrange an earth-closet indoors?

Have plenty of sifted ashes, or light, but not sandy, soil, with galvanised iron pails that can be changed daily, or oftener. The room must be well ventilated.

How can a cistern be provided for an outdoor water-closet for domestics' use without risk of freezing?

Place the cistern indoors next to the cupboard, where it will receive the warmth of the kitchen or laundry, and let the supply-pipe pass through the intervening wall, and no trouble will be experienced.

What is a good household disinfectant?

Carbolic acid diluted with water can be used in many places; lime is good for cellars and chicken-houses, but copperas dissolved in boiling water, a pound to a pail, will render the best service. Care should be taken to mix it in a vessel which must not be used for drinking-water, *as the solution is a deadly poison.*

Is there any way to make a tin or galvanised iron slop-pail odourless ?

Coating with coal-tar when the pail is hot will serve ; but it may be cheaper to use heavy enamelled iron instead of lighter metal, as the lighter material is easily bent out of shape.

MISCELLANEOUS

Is it dangerous to live near a cemetery ?

Yes, if there is any chance of contamination of wells. The continued sickness in the Brontë family, in the parsonage at the head of the rugged street of the Yorkshire village of Haworth, has been attributed to the circumstance that the house and the family well were just below the crowded village burying-ground on the top of the hill.

Is there any way to kill mosquitoes when they have got into a house ?

Mosquitoes can be killed indoors with a little paraffin oil ignited on the cover of a tin or pail, fastened to an old broomstick by a nail, and moving it about the walls and ceiling, but not near enough to "smudge." The fumes will cause the insect pests to drop into the receptacle.

How can one get rid of rats and mice from an old house without employing poison and having them die within the partitions ?

Use very strong spirits of ammonia with an ounce indiarubber syringe ; fill with the ammonia, squirt it into the hole where they came out and along the cracks of the surface. Send it as far under as possible.

Another method, which is used greatly on farms, is to spread a little white of egg on a cloth, sprinkle it with red pepper, and tack it over the mouse or rat hole—with the pepper inside.

Again, spread pieces of bread and butter with a little calomel, and leave a dish of water near it. They will eat, then drink, and die, but not near you.

How can one avoid the risk of cracking thin glass in opening windows to air a dining-room in very cold weather ?

Sudden changes of temperature may cause considerable damage to tableware, which can be avoided by taking the precaution to throw a heavy piece of cloth over the sideboard before opening the window. Lamp-chimneys will also crack if brought suddenly on a very cold day from outdoors into a warm room.

Do rats ever get into buildings through sewers ?

One authority speaks of rats ascending sewers and drains, diving through traps, and entering houses through basement water-closets.

Can you give any hints about managing paraffin-oil lamps in the home ?

Use oil of 120° F. flash-test. Take care to select the best burner possible. For putting out the light, have some mechanical means of shutting off the flame, or turn the flame down and blow across the top of the chimney, but never directly down into it. Boil the burners in water containing a little washing-soda to prevent creeping of the oil, as well as to clean them. Do not leave the lamps with the flame turned down. For carrying about the house, provide "packed" lamps, which have wicking saturated with oil and no liquid.

How can one avoid the risks of explosions in paraffin-oil lamps and stoves ?

The cause of these is that a certain amount of inflammable vapour is given off from paraffin oil according to the grade of oil. If the reservoir in the lamp or stove has stood partially filled for many hours, the space that is not filled with oil may become filled with vapour. When the lamp is lighted, a gust of air may carry the flame down to this inflammable gas, and an explosion result. The safeguards are: purchase the best quality of oil ; trim and fill the lamp every day ; and do not burn the lamp until practically all the oil is exhausted. There is also danger of explosion when the wick is not large enough to fill the burner.

What is the best position for a paraffin-oil tank when the space is limited in a dwelling ?

Do not keep the oil in a cold cellar or shed, where the housekeeper stands shivering while she fills the lamps.

Provide a galvanised iron tank, to hold a barrel of oil, placed above the kitchen sink, with a half-inch lead pipe and faucet. Replace the faucet-packing with soft lead, with a piece of half-inch brass tubing to insert into the top of a lamp when filling. Remove the filler from the cap, and solder a piece of brass over the hole. When the cap is screwed on over the brass tube it catches the last drop of oil, and prevents any loss of oil if the faucet is opened by accident. This outfit should cost under £2, and will soon pay for itself in the saving on spilled oil, soiled clothes, soap, doctor's and druggist's bills.

THE STANDARD PHYSICIAN

STRUCTURE AND FUNCTIONS OF THE HEALTHY HUMAN BODY

I.—INTRODUCTION

Owing to the fact that scientific research proves more and more that the entire mechanism of our mind is altogether dependent upon our body, it need not surprise one that the general public is gradually awakening to the fact that a healthy and well-developed body is absolutely essential for both physical and mental work. The layman may already have found diversion in psychology and philosophy, but he is now beginning to recognise that the study of his own body is equally as interesting and profitable.

And, indeed, what is more interesting than a clear account of the structure and function of the human body? The importance of this knowledge, even for men who are not physicians, has already been recognised in earlier times by some of the foremost intellects. It is well known that Goethe, the most celebrated poet of Germany, studied anatomy in Strasburg for two years. As a youth, the well-known German philosopher Herder was also enthusiastic about anatomy. Even rulers have taken great interest in this science and devoted considerable time to it; it is only necessary here to mention Louis XIV., Alexander of Russia, Queen Christina of Sweden, and Frederick III. of Denmark. The value of a knowledge of the human body for the painter and sculptor was emphasised as early as the Middle Ages by such important artists as Leonardo da Vinci, Raffaele, Michael Angelo, and others; and to-day hardly anyone will question the benefit derived by art from the study of anatomy.

But even for ordinary practical life, a certain knowledge of the human body seems indispensable. Everybody who wishes to live according to the rules of hygiene should have a general idea of the structure of the human organs and of their relation to the entire system. The pressure of a finger, applied properly upon an injured blood-vessel, may succeed in saving a human life. Even a layman may give valuable assistance in such common, everyday injuries as fractures, sprains, and contusions, by applying a temporary dressing or by alleviating the pain of the patient until the physician arrives. Everything pertaining to health will remain a secret for ever unless there is some knowledge of the structure of the interior of the body and the workings of the organs.

II.—CHIEF CONSTITUENTS OF THE HUMAN BODY

In the first half of the last century, the microscope was perfected so far that the finer structures of vegetable and animal matter could be studied. The botanist Schleiden first made the sensational discovery that all vegetable matter is made up of a multiplicity of units, so small as to be invisible to the naked eye. This applies to the leaf of a plant as well as to its shoot; to the blade of grass as well as to the trunk of a tree. Since each one of

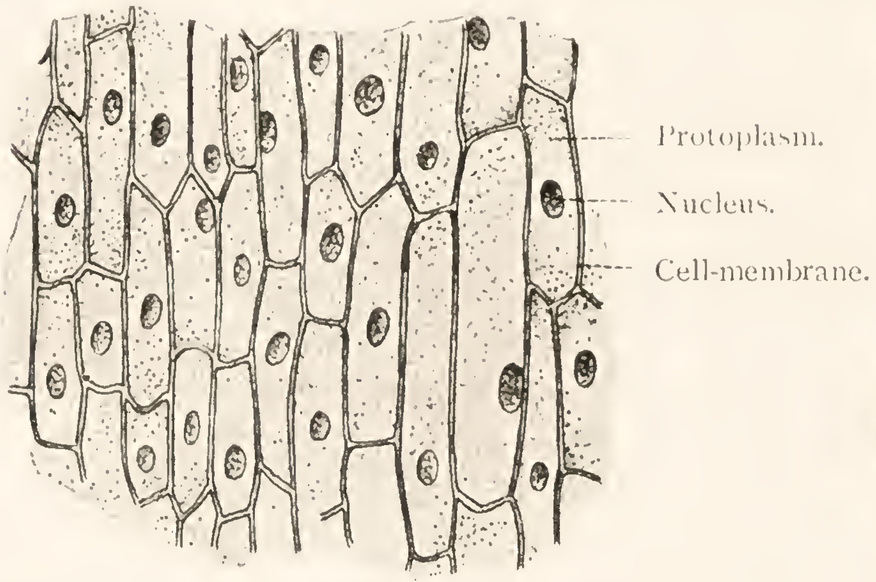


FIG. 1. Cells of the epidermis (skin) of an onion.

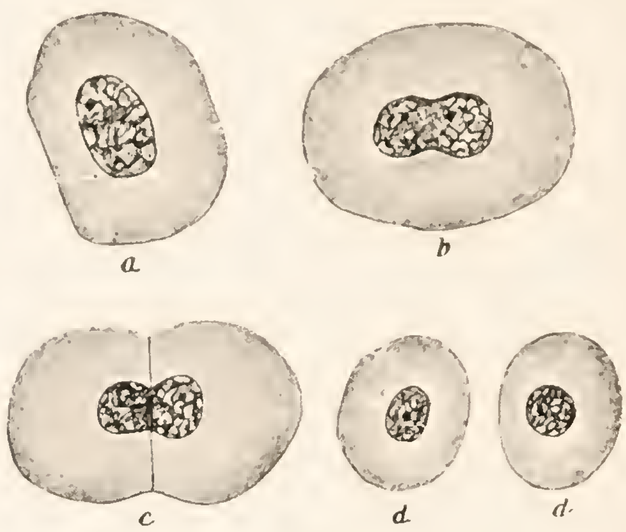


FIG. 2. Cells in division. *a* parent cell, *b c* with nucleus beginning to divide, *d d* daughter cells.

these units bears a certain resemblance to the cells of the honeycomb, the name cell has been applied to them. This cell is not, however, a cavity filled with air, but consists of the following parts: 1. The cell-membrane, which is composed of the true woody substance (cellulose) in plants, and in different plants it may be of varying thickness. 2. The cell-albumin, or protoplasm, the chief constituent of the cell, in which the vital processes take place. 3. The nucleus, a firm body embedded in the protoplasm, which plays an important rôle in the reproduction of cells. The changes which convert the mother-cell into two daughter-cells are first observed here.

That the body of man and of animals consists of cells just like the plant, was discovered somewhat later by the anatomist Schwann. The earliest stage in the development of man is the human ovum, whose size is that of a grain of sand and whose component parts, corresponding to those of the plant cell, are: 1. A rather thick cell-membrane. 2. A finely granular protoplasm, the so-called yolk, which contains 3. A rounded body, the nucleus (see Fig. 3). Like all other cells, the human ovum eventually divides into two cells, and these, undergoing further division, finally give rise to a group of cells from which the human body develops.

Though the body is also made up of structures not cellular in nature (ground-substance, fibres, granules and fluid), the cells are nevertheless the most important, since the vital processes of the body occur within them. The other structures must be looked upon as secretions of the cells, or as resulting from a collection of cells, as in the case of muscle and nerve fibres.

The human body thus forms a community of cells in which every one performs a certain function, like every man in a well-regulated community. Thus the nerve-cells of the brain and spinal cord are chiefly concerned with mental acts, such as thinking, feeling, etc.; the muscle-cells generate force. Cells of the salivary and gastric glands secrete digestive fluids

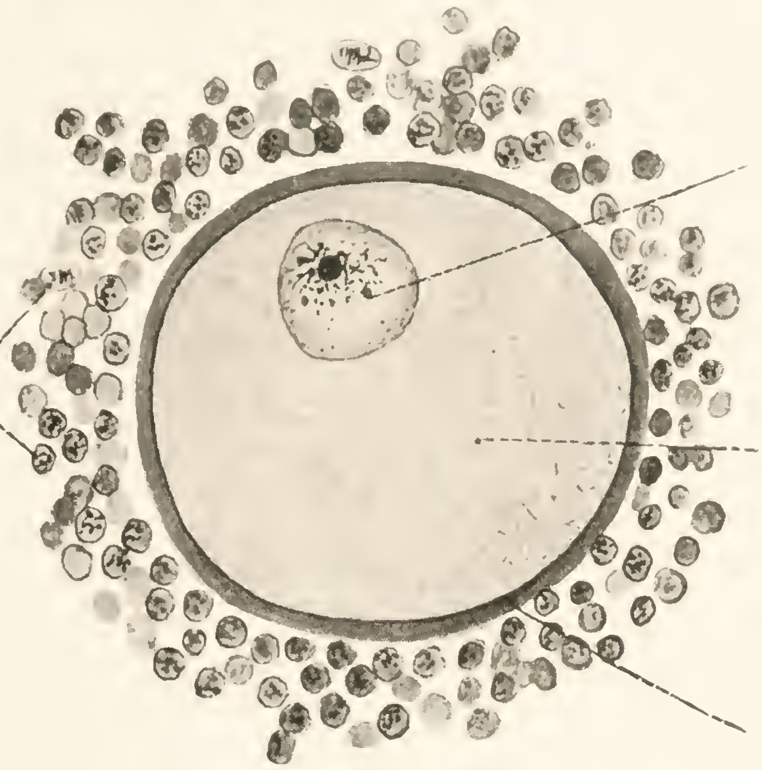


FIG. 3. Human ovum in the ovary.

which are of the greatest importance for digestion. To a certain extent, however, every cell is an independent organism, just as each member of a community preserves his independence despite his working to a common end with his neighbours. An individual cell may thus become diseased and may even undergo destruction while the surrounding cells still enjoy full vitality. But as soon as many cells in one particular organ are affected, the functions of the entire organ will be seriously interfered with. It is possible that too many or too important organs of the human body may be thus affected, so that the entire system is so seriously injured that death results.

The shape of animal cells varies considerably. They may be round, cuboid, polygonal, or even disc or star shaped. No matter what the shape, the three chief parts (protoplasm, membrane, and nucleus) can always be detected. In young cells, however, the membrane may be poorly developed or absent entirely.

The size of cells also fluctuates within wide limits. The yolk of an ordinary egg is to be looked upon as an exceptionally large cell. Each single grain of the spawn of fish is a single cell, but each cell of the human body is too small to be seen without a microscope, with the exception of the human ovum, which is about as large as a grain of sand and can just be seen with the naked eye. The vegetable cells known as bacteria (bacilli, micrococci, etc.) are exceptionally small cells which can only be seen distinctly if the magnifying power has reached a thousand diameters. Many play an important rôle as the cause of infectious diseases (the comma bacillus in cholera, the tubercle-bacillus in consumption, etc.; see BACTERIA).

The vital activity of cells, already referred to, manifests itself chiefly (1) by the exchange of fluids; in other words, the absorption and excretion of certain substances, and (2) by evidences of motion, common to the protoplasm of many cells.

Exchange of fluids is carried out as follows: The cell attracts certain chemical principles from the fluid which surrounds it; these are then modified as in a chemical laboratory, and whatever is not necessary for the building-up of new tissue or for nourishing the cell is again cast off. In this respect every single cell behaves like a more complex animal which also takes in substances of which a part is used and the remainder excreted. It is difficult, however, to observe these processes in the cell itself; yet, when an organ consisting almost exclusively of cells, such as the liver, elaborates large amounts of fluid—in the case of the bile—the inference is certainly justified that each single cell also secretes bile.

That the cell really possesses vitality is much better demonstrated by the presence of motion. With certain cells of the human body this may be seen directly under the microscope. There are certain cells in the blood, the so-called white corpuscles (see Fig. 23), which behave in many ways like certain lower animals. They can change their shape, send out processes, engulf certain small bodies, and travel large distances through the body, so that they may even leave the system altogether. The so-called ciliated cells, which line the human air-passages, also show signs of motion. They are called ciliated because they are beset with fine hairs (cilia) which give evidence of extremely active motion. It is through them that small particles of dust, etc., which have entered the air-passages, are again passed out. The muscle-fibres which result from the union of separate cells also possess motility, since they may contract and again relax. All these phenomena prove clearly that every cell is a small, living organism, which will manifest its vitality in different ways, depending upon the work allotted to it in the human system.

A cement-substance, which is found here and there between the cells, forms a sort of embedding mass for the latter. It is not present in the early stages of growth, but is excreted later by the cells. In bones this cement-substance is very hard, owing to the presence of the salts of lime. In other tissues it may be soft, tough, or even elastic. One may even look upon the blood as consisting of cells which float in a liquid ground-substance. The fibres which occur in the human body may originate like muscle and nerve-fibres by the union of apposed cells, or else are enclosed in the ground-substance, like the connective-tissue fibres to be described later.

Granules may be found in the human body both within and without the cells. Little is known of their chemical composition, except that they usually consist of albumen or fat. Pigment granules may also belong to the normal elements of the human body. They, too, may be enclosed within the

cells or lie external to them. The colour of the skin, hair, or eyes depends upon types of these granules.

Quantitatively, water is the most important constituent of the human body, even when we exclude fluids like perspiration, saliva, and urine, which must be regarded as excretions. Fluids, like blood and lymph, that form an integral part of the body itself are, however, present in such large quantities that they constitute as much as 80 per cent. of the entire body-weight. It follows that if a human corpse dries up completely or becomes mummified, it will lose four-fifths of its weight.

The fluids are all albuminous solutions, containing different salts. The most important are (1) the blood, and (2) the lymph. The former is characterised by its red colour; it circulates in a closed system of tubes, the so-called blood-vessels, while the lymph is clear as water and saturates all the tissues of the human body. Eventually, however, the lymph also collects in certain vessels which unite with each other and finally join the largest vessels in the form of two trunks of considerable size.

III.—TISSUES OF THE HUMAN BODY

If a certain number of the elementary structures already described unite to form one whole, it is spoken of as a tissue, even though the elements are not necessarily interwoven, but often merely lie side by side. Five different kinds of tissue may be recognised in the human body: (1) Epithelial tissue; (2) Connective tissue; (3) Muscle tissue; (4) Nerve tissue; and (5) Blood and Lymph.

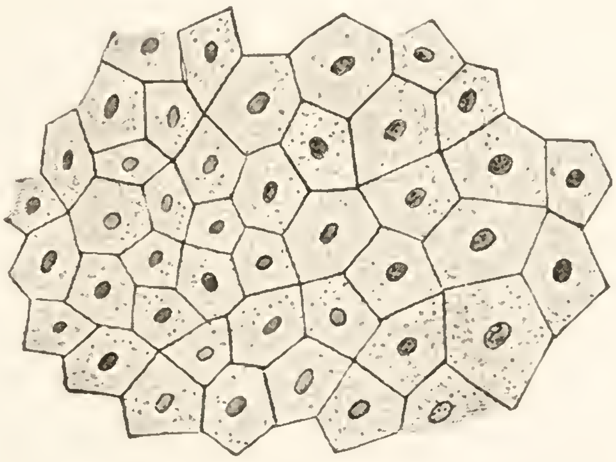


FIG. 4. Pavement epithelium of the skin.

1. **Epithelial Tissue** is characteristic in that it consists exclusively of cells which are so closely in contact that only a very small amount of cement-substance is interposed. The epithelial cells form thick or thin plates (pavement epithelium; see Figs. 4 and 5), or upright cylinders (cylindrical epithelium; see Fig. 6), which are provided in certain places with fine hairs (ciliated epithelium; see Fig. 7). In addition to the above, the cells may occur in various other shapes.

Pavement epithelium occurs in more than one layer and is found, among other places, upon the surface of the human body. Cylindrical epithelium

lines the interior of many cavities, such as the stomach and the intestines, while ciliated epithelium clothes the inner surface of the larger part of the respiratory tract. In all these instances the epithelial layer forms a protection for the tissues lying underneath it; and as soon as there is a break in the layer, the latter are exposed to injury. The epithelial cells also form an integral part of the glands of the human body, where they serve to elaborate the secretions.

The term gland is applied to every organ which secretes certain substances necessary for the proper function of the body. Thus, there are salivary glands, gastric glands, mucous glands, sweat glands, sebaceous glands, the

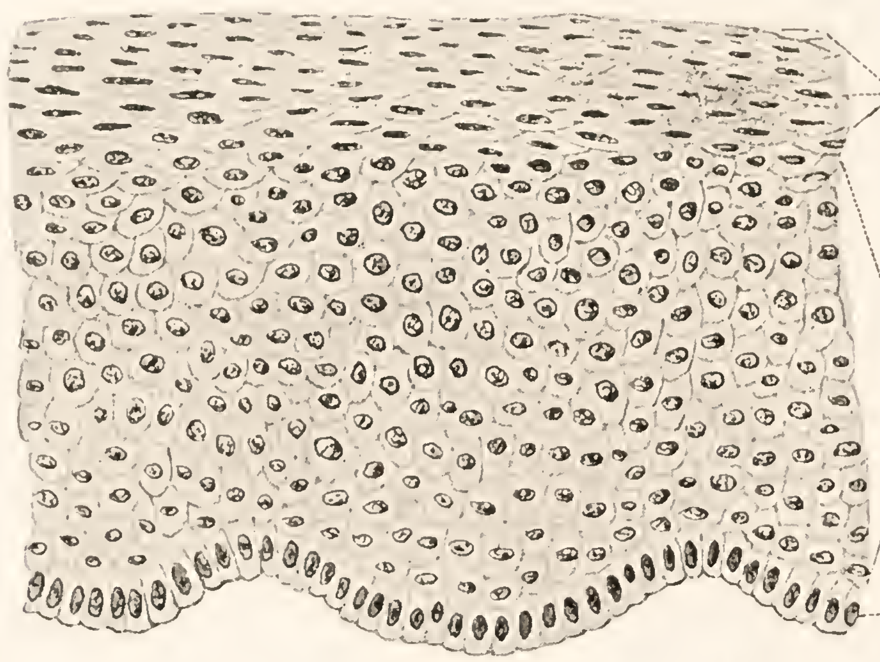


FIG. 5. Epithelial layers in the skin, cross-section.

liver, the pancreas, etc., and the name generally indicates the nature of the secretion. The most primitive type of a gland is a simple tube, the inner surface of which is lined with epithelial cells (see Fig. 8). The secretion formed by the latter empties upon the surface in the direction indicated. The so-called simple glands cannot be seen with the naked eye, but require the use of a microscope. It happens, however, that many of these tubes unite and discharge their secretion into a common excretory duct. In this case the term "compound gland" is used (see Fig. 9). If many of these ducts, like the tributaries of a stream, unite in forming a large, common duct, a gland of this type may form an organ of great size. The liver and kidneys may be mentioned as the largest glands of the human body. The lymph-glands should not be confused with these true glands. They are better known by the laity, since, when inflamed, they swell and form large nodes which are readily seen and felt. They do not, however, secrete in the true sense of the word, and are not supplied with excretory ducts.

2. The term "Connective Tissue" includes many tissues which serve to support or to embed various organs of the human body. The group includes: (1) Connective tissue proper; (2) Fatty tissue; (3) Cartilage; and (4) Bone.

(1) *Connective Tissue proper* also consists of cells, but these are very small and insignificant and are embedded in a large amount of ground-substance which is characterised by a remarkably fibrous structure. These

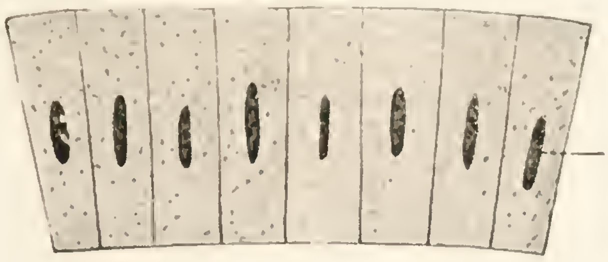


FIG. 6. Cylindrical epithelium.

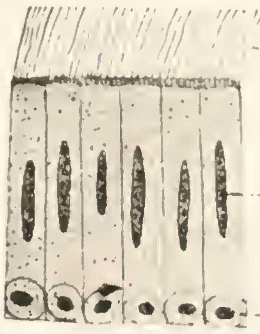


FIG. 7. Ciliated cells.

connective-tissue fibres are generally arranged in bundles or larger bands. Two chief varieties are found in the human body—loose and firm connective tissue.

In loose connective tissue the separate fibres or bundles are arranged in wider meshes, like a mass of woollen thread (see Fig. 10). It is therefore more elastic and can be displaced more readily, and hence is found where certain organs are movable upon each other. Wherever the skin can be

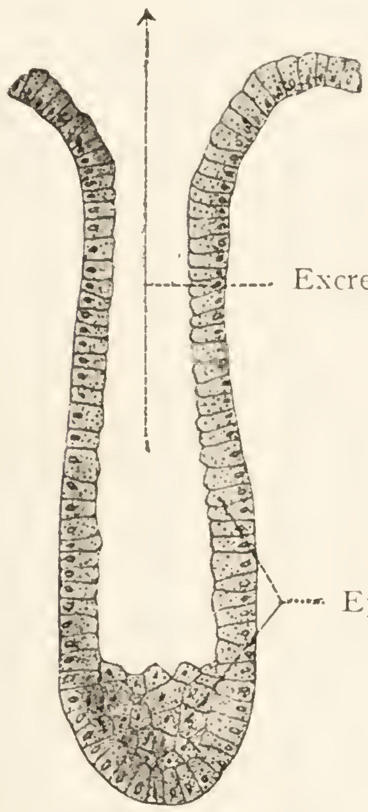


FIG. 8. Simple gland.

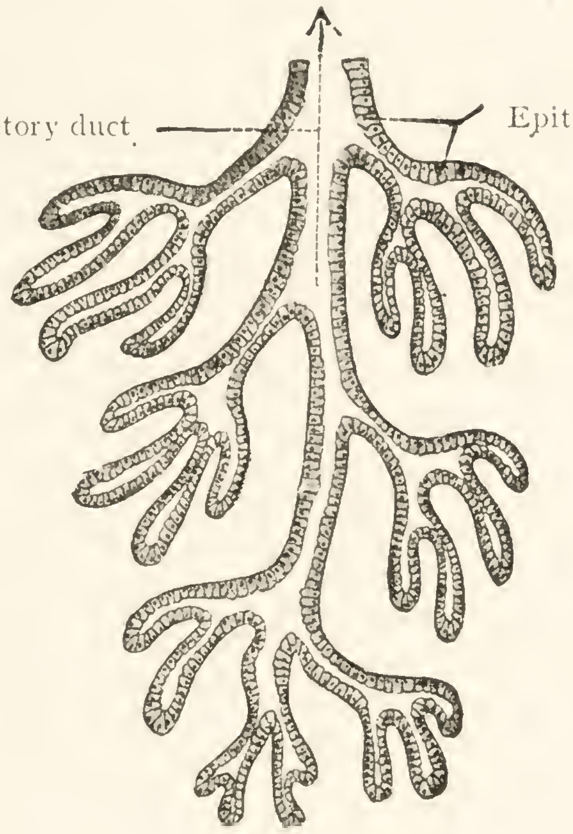


FIG. 9. Compound gland.

easily picked up in folds, loose connective tissue is present ; and a certain amount is placed between the different muscles, so that these can easily contract without friction. Loose connective tissue forms a light-grey mass, which can also be seen in the red meat (muscle) of animals. Owing to its lax condition it may be easily distended with air, by blowing through a fine tube. This was formerly practised by butchers, in order to improve the appearance of meat.

In firm connective tissue, the fibres are placed side by side, like the threads in a piece of cloth, or else are firmly interwoven. The consistency is

much firmer. Examples are the tendons, whose fibres run parallel (see Fig. 11), the various ligaments which hold together the bony frame-work, and the different membranes of the human body. The latter, however, form a network, more or less firm, whose fibres frequently run in all directions. The corium, pleura, pericardium, peritoneum, renal capsule, and the membranes of the brain belong to this group.

When either loose or firm connective tissue is boiled in water, the fibres swell up and dissolve to a jelly-like mass, known as gelatine or glue. This process also goes on during the boiling and frying of articles of food;

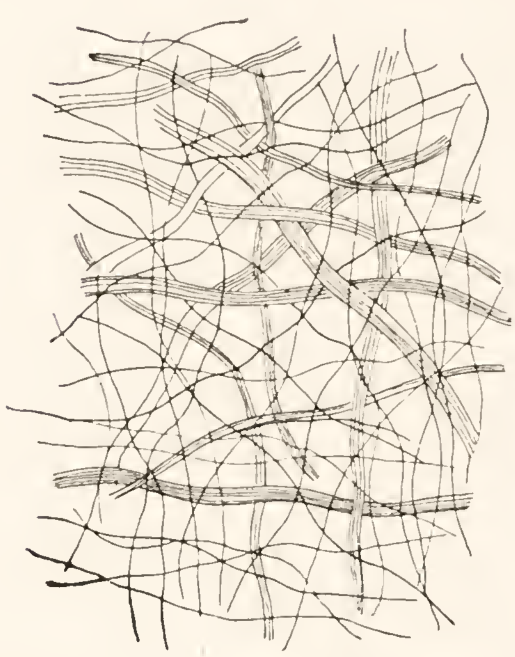


Fig. 10. Loose connective tissue.

Fig. 11. Fibrous connective tissue of tendon.

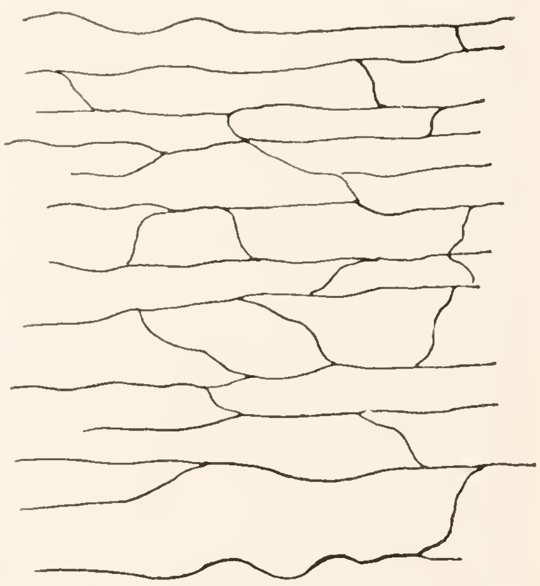


Fig. 12. Elastic fibres in connective tissue.

and the solidification of the juice as it leaves the meat is caused by the formation of gelatine. The glue used in the industries is also manufactured by boiling organs rich in firm connective tissue, such as hoofs and horns of cattle. The action of acids on connective-tissue fibres is similar to that of boiling, since swelling and solution will eventually take place. Meat is often placed in vinegar or sour milk in order to soften the fibres, and thus render the meat more readily digestible. Frequently the connective-tissue fibres are accompanied by the so-called elastic fibres. These retain their strength and elasticity; in fact, are not altered at all by boiling or by the action of acids. They also differ in appearance from the usual connective-tissue fibres, since they are always net-shaped (see Fig. 12).

(2) *Fatty Tissue* is really nothing but connective-tissue in whose cells large amounts of fat have been deposited, so that they appear round, like cannon-balls (see Fig. 13). When fresh, the colour of fatty tissue is white or pale yellow. It is chiefly of value to the animal body in that it forms a reserve deposit of nourishment whenever the normal supply of food is cut off for any length of time. Most wild animals store up large amounts of fat during

the summer, which serve as food for the winter when the normal supply is less abundant. This is especially well seen in the hibernating class. Another valuable property of fat is its poor conductivity of heat, which prevents too active dissipation of heat from the organs which lie underneath it. Even in men with good development of the muscles, a certain amount of fat

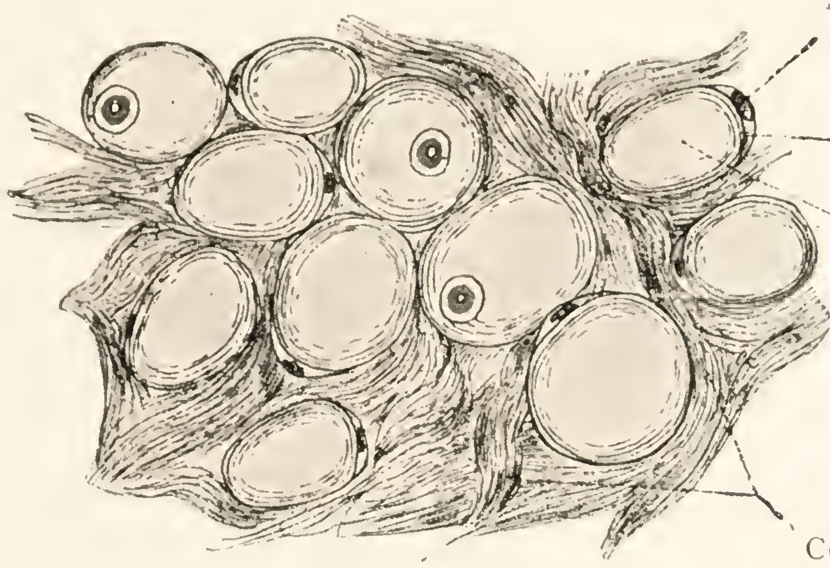


FIG. 13. Fatty tissue, the nuclei showing in some cells.

under the skin is of decided advantage during the cold season. Stout individuals will feel the cold less intensely than those with less fat ; on the other hand they will suffer more from the heat of summer, since the excess of heat from their own bodies cannot so readily find an outlet. Finally, the fat acts as a soft cushion or support for delicate organs which would be easily injured by pressure or blows of any kind. Thus the kidneys are embedded in layers of fat ; and the eye proper lies in a soft cushion, which fills up the entire orbital cavity. Should the fat accumulate excessively either within or outside of the organs, the symmetry of the body will be interfered with, and the organs themselves (as the muscles) may suffer, since their tissues will be compressed and destroyed.

(3) *Cartilage* appears like porcelain with bluish-transparent shimmer. Besides a certain amount of firmness, it possesses also ductility and flexibility. As in other tissues, cells are also found here, but these are embedded in a firm, translucent ground-substance. Cartilage is found throughout the body wherever a certain amount of firm support is required, without loss of ductility. A good example is the tip of the nose. This would break or change its form more readily if the partition between its two halves consisted of bone instead of cartilage. The skeleton of infants during the first years of life is also in great part cartilaginous ; for this reason they may fall while attempting to walk without readily sustaining a fracture. In adult life the front ends of the ribs remain of cartilage, so as to facilitate the movements of respiration. The ends of the bones which enter into the formation of joints are covered with cartilage, the smooth surface of which reduces friction to a minimum. It may happen that this cartilaginous layer is lost with advanced age, in which case the bones will rub against each other. It

is for this reason that old people so frequently complain of stiffness and pain in the joints. The elasticity and ductility are more marked if many elastic fibres are embedded in the ground-substance, as in the cartilage of the ear. Even if stretched or distorted to a marked degree, this will again resume its original shape. See Fig. 14.

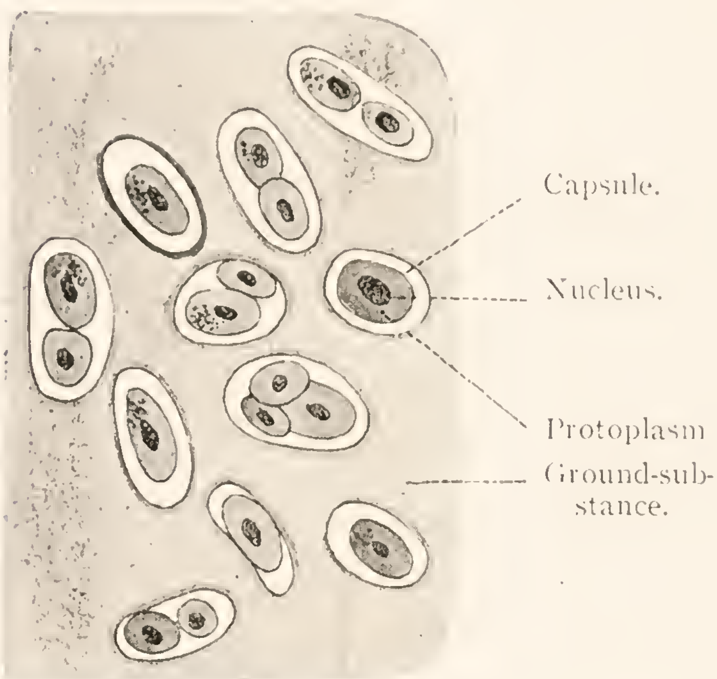


FIG. 14. Cartilage cells slightly contracted and separated from the ground-substance.

(4) *Bone*, despite its firmness, also consists of cells, characterised by being star-shaped, with many projections, which connect each cell with its neighbours (see Fig. 15). The ground-substance in which these cells lie is of stony hardness owing to the presence of large amounts of phosphate and carbonate of lime. These salts may be extracted by placing the bone in an acid such as muriatic acid. What remains behind will still retain the original shape, but will be more flexible and less resistant, like cartilage. In that peculiar disease of children, known as rickets, the deposit of lime-salts in the bones is deficient, or absent altogether. The numerous consequential disturbances are described more carefully under RICKETS. The dense network of blood-vessels found everywhere in bone is known as the system of Haversian canals.

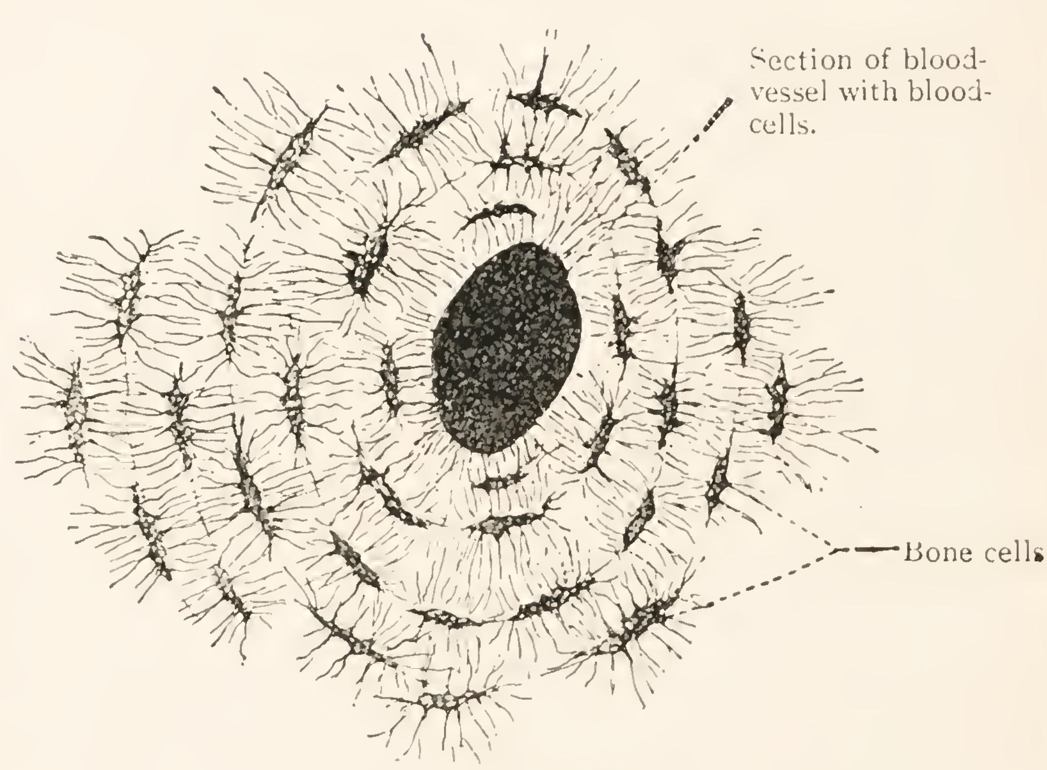


FIG. 15. Bony tissue.

3. **Muscle** is found in the human body in two forms: (1) Striated Muscle; and (2) Smooth Muscle. The chief elements are the muscle-cells or fibres, which are peculiar, in that they contract and shorten.

(1) *Striated Muscle* is nothing but the red meat of animals employed as food. Under the microscope, it is seen to consist of fibres, known as muscle-fibres, showing an occasional nucleus and a delicate cross-striation (see Fig. 16). A striation may also be observed with the naked eye, since the fibres are arranged side by side in bundles which are separated by a considerable amount of loose connective tissue. Connective-tissue fibres are

also found between the individual fibres. If much firm connective tissue is present in a muscle, the meat will be tough when prepared. At both ends of a muscle the fibres change into tendon fibres.

Every single striated muscle-fibre possesses the property of contracting under the influence of the will. As a result the fibres will appear thicker and shorter, and the two tendinous ends will approach each other. Since the tendons are almost always fixed to some bone, it follows that the bones will also be approximated as the muscle contracts, (see Figs. 17 and 18). All active motions of the skeleton have their origin in a contraction of muscle-fibres.

A number of other irritations besides our own will may bring about a contraction of striated muscle-fibres. If a severe blow be directed against a muscle, it will harden, and an involuntary twitching may be observed which results in a movement. The same thing will happen if a strong electric current is passed through the muscle. Both forms of irritation (the physical manipulation

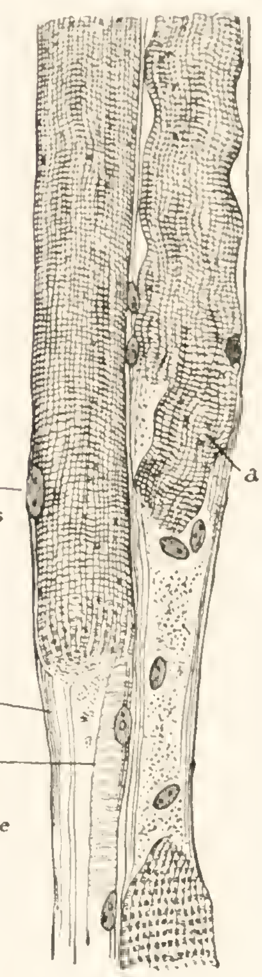


FIG. 16. Striated muscle.

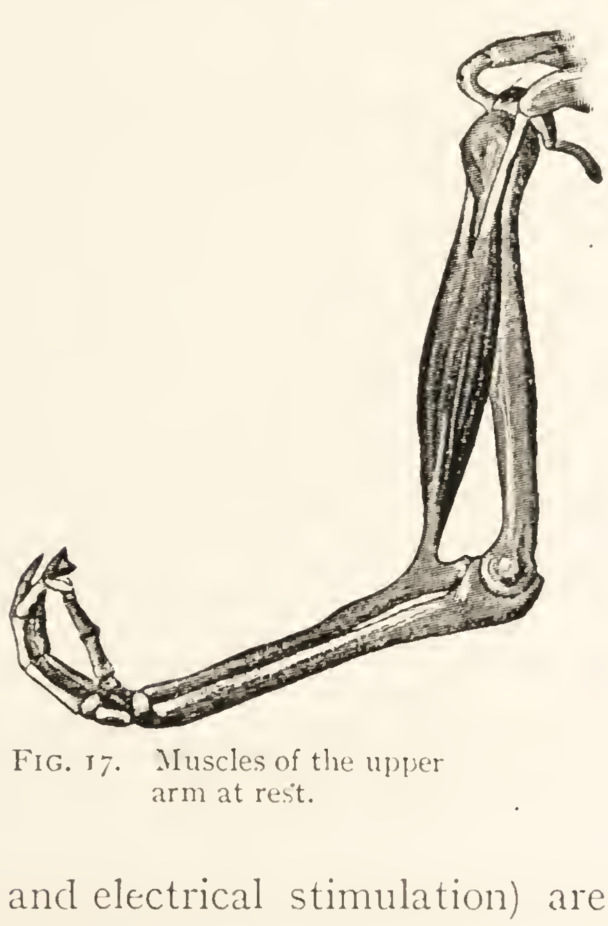


FIG. 17. Muscles of the upper arm at rest.

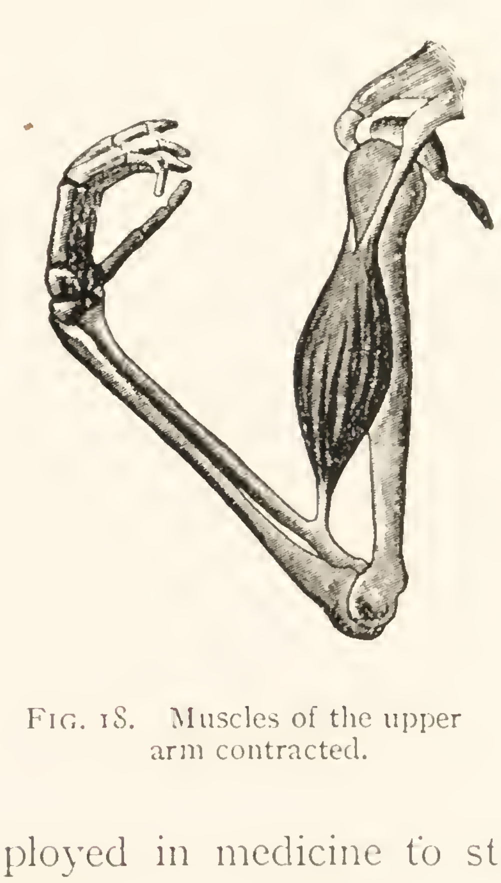


FIG. 18. Muscles of the upper arm contracted.

massage and electrical stimulation) are employed in medicine to strengthen weak and flabby muscles.

(2) *Smooth Muscle-Tissue* is made up of long, spindle-shaped cells, which may also be so arranged as to form bundles. They are called smooth,

since the individual cells do not exhibit any cross-striping, as in the case of striated muscle. To the naked eye, however, this form of tissue does not appear smooth, but fibrous. The fibres which frequently fall out of the stomach of a goose which is cut open after being cooked for a long time are bundles of smooth muscle-fibres. They are abundant also in the human and animal uterus, and also in other organs, as in the walls of the stomach and intestines. Their function here is to propel the food onward. In the walls of the urinary bladder, the smooth muscle-fibres serve to discharge the urine, if this organ is filled. The smooth muscle-fibres are frequently arranged in a ring-shaped manner, as about the pupil of the human eye. When light falls upon the eyes, contraction will narrow the pupils. Ring-shaped fibres also play a very important rôle in the blood-vessels of the human skin. Their contraction will here narrow the vessels, and diminish the amount of blood carried to the skin, since less fluid will pass through a narrow than through a wide tube in the same space of time. Frequently a ring of smooth muscle serves to close off a cavity so that the contents are not discharged. A good example is the anus.

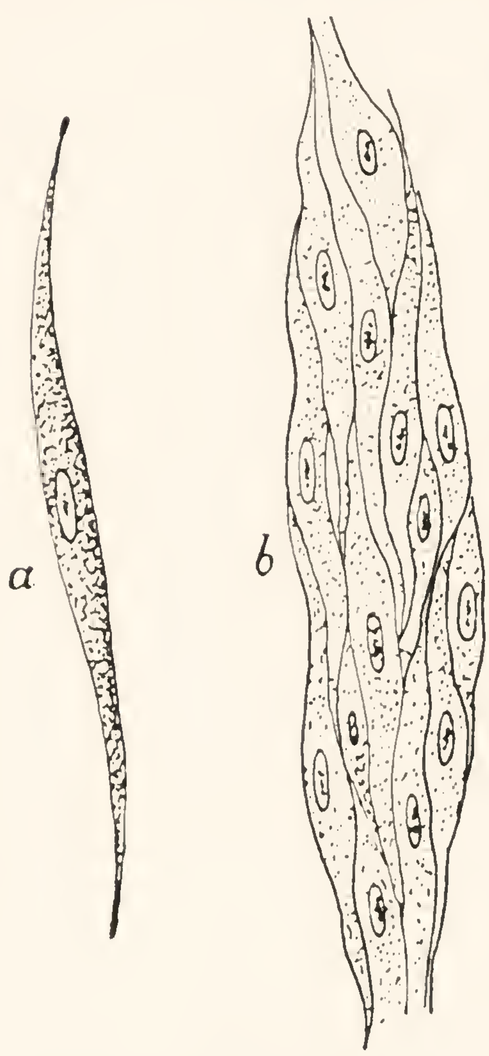


FIG. 19. Smooth muscle-fibres. *a* an isolated muscle-cell, *b* muscle-cells in a bundle.

Striated muscle is always under the control of our volition, and its contractions result from an impulse from the brain. Smooth muscle, on the other hand, is not influenced by our wills. It may even contract against our wills, as in the case of stomach cramps or painful diarrhœa. Striated muscle shows fatigue readily, but smooth muscle may remain in a contracted condition for a long time, or even continuously, without showing any ill-effects. Certain drugs (lead-water, tannic acid, etc.) can bring about a contraction of smooth muscle-fibres; while others, as opium, relax them. The same can be said of different degrees of temperature. During cold weather, the smooth muscle-fibres in the vessels of the skin will contract so that the skin appears pale. A temperature of about 100° F. will relax the fibres, as a consequence of which the skin will redden. If still higher degrees of temperature act very suddenly upon the skin a rapid contraction follows. This is well seen in the so-called goose-skin which forms in a very hot bath.

The muscle-fibres of the heart occupy an intermediary position between striated and smooth muscle-fibres. They possess striation, but contract without or against our will.

4. **Nerve-Tissue** consists chiefly of the nerve or ganglion cells, which are

connected among themselves and with the different organs of the body by means of fine fibres, so-called nerve-fibres, which serve to conduct the impulses from cell to cell.

Nerve or ganglion cells occur in large numbers, almost solely in the central organs (brain and spinal cord). They form comparatively large cells with distinct, vesicular nuclei. Their shapes vary, but generally they appear star-shaped owing to the presence of a larger or smaller number of projections. Each one of these projections passes over into a delicate fibrous process which either communicates with other nerve-cells or passes through the body, to end in some organ. The nerve-cells are the seat of the intellectual life of man. Volition and imagination, and the processes of thinking and perceiving, originate within the nerve-cells and are dependent upon them. If all the nerve-cells of the human body suddenly ceased to act,

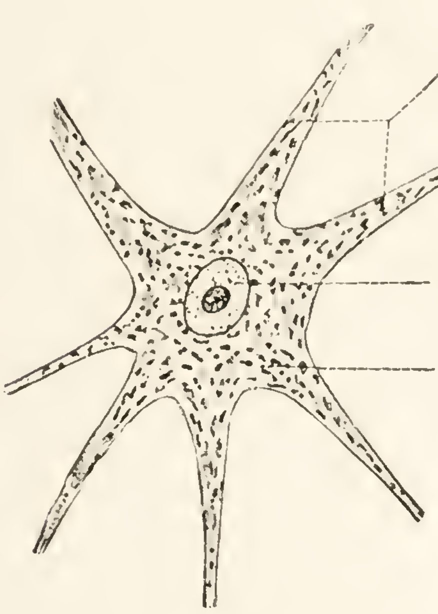


FIG. 20. Nerve-cell in part.

FIG. 21. Fibre part of nerve-cell.

all intellectual life would come to an end at the same moment; but if only some of them were destroyed, only that part of mental activity which resided in the destroyed cells would be lost. There are also nerve-cells whose only duty it is to preside over the function of speech. The destruction of these cells would cause the individual to lose his ability to speak. It is, however, impossible to explain how all the various psychic phenomena are carried out within the nerve-cells.

Nerve-fibres possess a cylindrical shape, but are more delicate than muscle-fibres (see Fig. 21). They are the continuations of the processes of the nerve-cells, and are in reality a part of them, nerve-fibre and nerve-cell together making what is known as a nerve unit or neuron. Their course is through brain and spinal cord; after they leave these organs they unite with others to form thin or thick strands, and course through the body, to end finally in some viscus. The nerve-fibres may thus be likened to wires carrying messages from the brain and spinal cord to the various organs of the human body. The brain and spinal cord may be regarded as central stations,

the nerve-fibres as the telegraph wires which run from them to the smaller sub-stations, the organs of the body. At their exit from the brain or cord the nerve-fibres are united into fine or coarse bundles which pass through certain openings in the skull or vertebral column, and then break up, first into larger, and then into finer branches which are too small to be seen with the naked eye in the organs themselves. They end there in certain end-apparatuses, such as the tactile corpuscles of the skin, or the nerve-end-plates of the muscles which are here described.

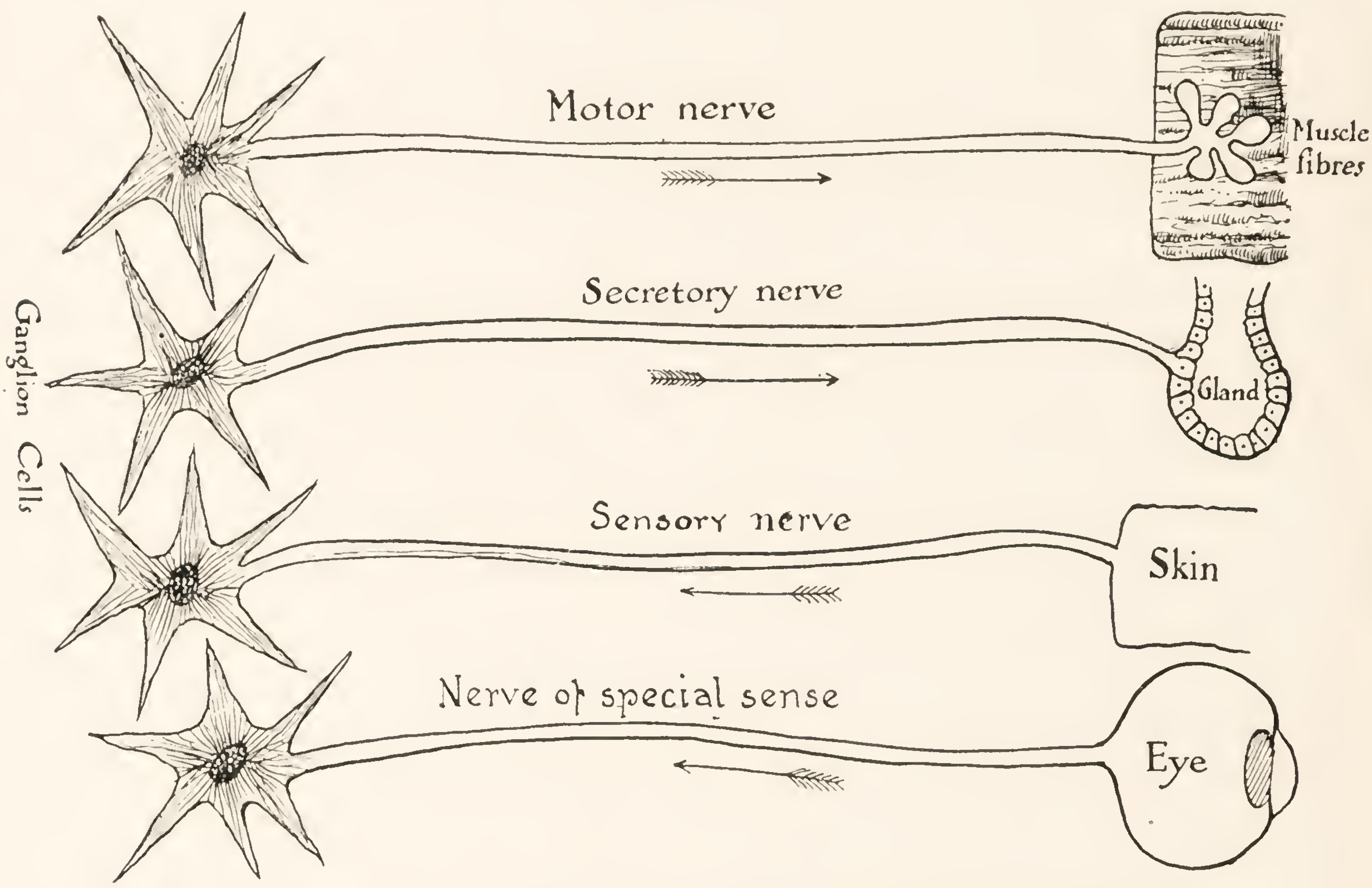


Fig. 22. Showing the course of the nerve-fibres between the nerve-centres and the end-organs.

The nerves and nerve-fibres may be classified as follows, according to the organs in which they terminate: (1) Motor Nerves; (2) Secretory Nerves; (3) Sensory Nerves; and (4) Nerves of Special Sense.

(1) *Motor Nerves* terminate in muscle. Before a certain muscle contracts, the impulse to do so originates in one or more nerve-cells of the brain. This impulse then travels downward through certain nerve-fibres, finally reaching the corresponding muscle, which responds to the stimulus by contracting (see Fig. 22). These motor nerves can never transmit a sensation back to the brain; their sole function is to induce muscular contraction.

(2) *Secretory Nerves* are those that end in a gland and control its secretion (see Fig. 22). If a dog smells food, one can easily observe how the saliva gathers in his mouth. The perception of a welcome morsel here acts upon the brain as a stimulus which is then carried through certain nerve-fibres to the salivary gland, increasing the activity of the gland-cells. The secretory nerves are likewise unable to transmit sensations of pain, the stimulus travelling only in one direction; namely, from the brain to the gland.

(3) *Sensory Nerves* serve solely as carriers of sensations from some point of the body to the brain (see Fig. 22). The impulse, therefore, must travel in a direction opposite to that of motor or secretory nerves. If the skin is pricked, the stimulus travels, by way of special nerve-fibres, up through the spinal cord to the brain, where it gives rise to the sensation of pain. Sensations of taste, heat, cold, motion, etc., are conveyed to the brain in like manner.

(4) *The Nerves of Special Sense*, which are also particular sensory nerves, likewise convey impulses to the brain, where the impressions received by the special senses are recorded. Thus, the light-waves received by the eye, or the sound-waves which reach the ear, stimulate the corresponding nerve-endings, and are thereupon transmitted, by way of the optic or auditory nerves, to the brain, where they enable the process of seeing or hearing to take place.

It follows from the above that every special nerve-fibre can transmit only one special form of stimulus. The optic nerve may be cut through without giving rise to pain ; the individual operated upon merely receives the sensation of light. If a pain-carrying nerve be divided, a sensation of pain is the result ; while the division of a motor nerve gives rise to a twitch in the muscle supplied by this nerve. The severance of a glandular nerve is followed by a transient, increased activity of the corresponding gland.

Electrical currents or chemicals have exactly the same effect as mechanical irritations, such as cuts, blows, or contusions. If a motor nerve be moistened with some caustic fluid, the result will be a muscular twitch. Warmth and cold can also irritate or even paralyse the nerve-fibres to a marked degree. An individual sitting against a cold draught may thus acquire a complete paralysis of that half of the face which is directly exposed to the current of cold air. Severe chilling of sensory nerves may also give rise to painful rheumatic conditions.

5. **Blood** and **Lymph** may also be classified among tissues, even though it may seem strange that a fluid should be called a tissue. Microscopical examination, however, shows that we are here dealing with cells which are suspended in a fluid ground-substance.

Blood is enclosed in a system of branched tubes, known as the blood-vessels. The amount of blood in the human system is less than one would assume. Taking an adult individual of medium size, the total quantity corresponds to about eleven to thirteen pounds. The cells of the blood are termed blood-corpuscles ; the fluid, blood-plasma. The latter constitutes a dilute solution of albumen containing other substances, such as salts, either temporarily or permanently. The blood-corpuscles may be divided into two classes, the red and the white cells.

The red cells give rise to the characteristic colour of blood. With a high magnifying power they appear as very small, round discs whose surfaces are

hollowed out like the discus used by the ancient Greeks (see Fig. 23). There are about 5,000,000 red blood-cells in a cubic $\frac{1}{25}$ of an inch. Their average diameter is $\frac{8}{25000}$ of an inch. The red cells are important elements of the blood, since they are the carriers of hæmoglobin, the specific red colouring-matter of the blood, which contains a certain amount of iron. This hæmoglobin possesses the property of attracting the oxygen from the air, which gives it its bright red colour. This process goes on in the lungs during respiration. The red corpuscles absorb oxygen from the air inhaled as they are propelled through the minute vessels of the lung. The cells then carry the

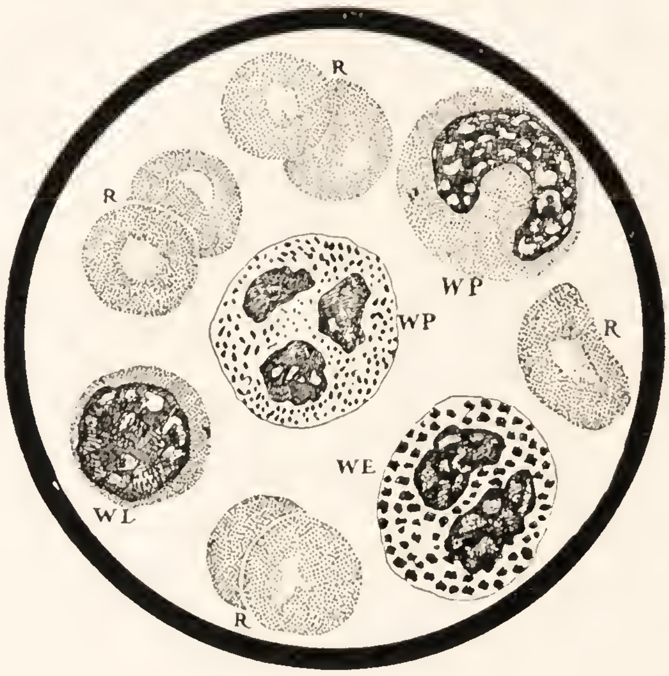


Fig. 23. Blood-cells.
R red blood-corpuscles, *W L* lymphocyte, *W E* eosinophile, *W P* polymorpho-nuclear leucocytes.

oxygen to the various organs, where it is passed over to the tissue-cells and utilised to build up organs or to generate animal warmth. The highly important function of the red blood-cells for the animal economy is thus evident. Life will cease at once if the body no longer receives its supply of oxygen. General disturbances soon set in if an individual has too small an amount of red blood-colouring matter, as in chlorosis or anæmia, the colouring matter present being insufficient to secure the necessary amount of oxygen for the organs.

The colourless or white blood-corpuscles (see Fig. 23, *W E*, *W L*, *W P*) are larger in man than the red cells ($\frac{10}{25000}$ inch), but are much less abundant. Normally, one colourless corpuscle goes with 300 to 400 red corpuscles. When resting, or deprived of vitality, they are round; but, under normal conditions, they frequently behave like snails, in that they send out and draw in projections of their protoplasm, and frequently they change their position by means of these projections, so that they may travel over a considerable distance within the human body. They may even migrate out of the body, in certain excretions like mucus or saliva. They possess the property of drawing themselves out so that they may pass with considerable force through openings which are invisible under the microscope, even with high magnifying power. The yellow fluid generally known as pus is made

up chiefly of these migrated white blood-corpuscles. Expectorated mucus, if tinged yellow, also contains many of these elements. Another important property of these peculiar cells is their power of engulfing or "devouring" small bodies, such as granules of pigment, bacilli, etc. Since such cells may also wander out of the body, the system, and with it the various organs, is thus able to rid itself of certain harmful substances. Owing to this property, the white cells have frequently been termed the "guards of the human body."

The blood-plasma, or fluid in which the cells just described are suspended, possesses the important property of clotting as soon as it leaves the vessels. If **an artery** of a living animal be opened and the blood be caught in a vessel, one may observe that it gradually turns more viscous and jelly-like. A little later a reddish clot, the blood-coagulum, becomes separated from a more yellowish fluid, the blood serum. The blood-coagulum consists of red corpuscles, enclosed in a peculiar fibrous substance known as fibrine. If freshly discharged blood be beaten up during the process of clotting, the fibrine will collect upon the beater in the form of tough fibres which exhibit a greyish-white colour if washed.

Clotting in an injured blood-vessel is in every way analogous to clotting outside of the body in a glass receptacle. The process leads to the formation of a clot of the same composition as here described, which, by closing up the opening in the injured vessel, causes the bleeding to cease, since no more blood can leave the vessel. It seems that in certain individuals who are predisposed to spontaneous bleeding ("bleeders"; see HÆMOPHILIA) the blood does not possess the normal power of clotting, and it may be very difficult to stop even slight hæmorrhages from insignificant wounds. Such people may bleed to death after trifling wounds.

If the blood-pressure is high within a blood-vessel, a clot will form less readily and the bleeding cannot be checked so easily. It is for this reason that clotting does not occur in the larger arteries of the body, and an injury to these vessels will be fatal if no physician is at hand. If a patient swoons, a serious hæmorrhage may cease spontaneously, the weakened action of the heart reducing the blood-pressure so considerably, even in the larger vessels, that a clot may form.

Lymph in a pure condition is also a watery solution of albumen, in which a few cells, the so-called lymph-corpuscles, are suspended. These do not differ from the colourless blood-corpuscles, and lymph may thus be regarded as blood minus the red blood-cells. Pure lymph is found in the blisters which form on the feet after wearing tight shoes, or in the palm of the hand after gymnastic exercise, or from burns or caustic applications. Within the body, the lymph constantly exudes from the blood-vessels, bathing all tissue-spaces between the latter. It finally collects in small, delicate vessels, the lymph-vessels, which unite into larger ducts. These finally join the blood-vessels not far from the heart. Small organs known as lymph-nodes or

lymph-glands, and varying in size from a pea to a bean, are interposed in the course of the lymph-vessels in various localities of the human body. They behave like filters by retaining certain injurious substances (poisons, bacilli, etc.) which may have contaminated the lymph. As a consequence, the lymph-nodes may inflame and swell up to the size of a walnut, or larger, so that they can be easily felt through the skin. Inflamed lymph-nodes may also suppurate, so that an incision will be necessary. It has been already stated that the common term " lymph-gland " is a misnomer.

The relation between blood and lymph may be explained by the following example: The blood circulates in a closed system of tubes, like the drainage pipes of a farm. The lymph may be compared to a fluid permeating the soil between the tubes. Small openings in the tubes then establish a communication between the water in the tubes and that of the soil.

IV.—THE HUMAN SKIN

The chief function of the human skin is to act as a protection for the organs which it covers. Its property to remove superfluous excretory products from the body, such as certain substances contained in the perspiration and the sebaceous secretion, is no less important. The skin may also be looked upon as a kind of respiratory organ, since part of the carbonic acid formed in the body escapes through it. In some of the lower animals, respiration goes on largely through the skin. Human skin consists of three layers: (1) Epidermis; (2) Corium; and (3) Subcutaneous Fatty Tissue; and of a certain number of Accessory Organs.

1. The epidermis is built up solely of epithelial cells (see Fig. 5). Under the microscope these can be seen to form two distinct layers, the Malpighian layer and the horny layer. Both layers are visible to the unaided eye in blisters, such as are made in the palm of the hand by rowing or other exercise; the one raised up by the fluid is the horny layer, whereas the reddish floor of the blister when this is incised forms the Malpighian layer.

The deeper cells of the Malpighian layer approximate the cylindrical shape, but nearer to the surface the flat type prevails. All these cells are in a state of active growth, so that those lost upon the surface by rubbing, washing, etc., are constantly renewed. In the coloured races, pigment granules are found in the cells of the Malpighian layer, the pigment being darkest in the black races.

The deeper cells of the horny layer are thick and flat; but toward the surface they gradually become thinner, finally forming very narrow scales. If compared with the softer cells of the Malpighian layer, they appear as if dried up, yet they are considerably more resistant, because the albuminous matter in them is converted into horny substance. Like other substances consisting of horny material (hair, nails, feathers), the cornified cells of the upper layers easily attract and retain water, which softens them and causes

them to swell. This is well demonstrated when bathing in warm water. Large quantities of the horny scales can be removed after the bath while drying the skin with a towel. Hard nails and corns are rendered so soft that they can be easily cut or scraped off. A certain amount of water, however, is always contained in the skin. If this evaporates more or less, the skin will turn brittle and crack easily. The largest amount of water is found in the skin after bathing. One may easily catch cold after a bath, since the evaporation of this water will remove considerable warmth from the body.

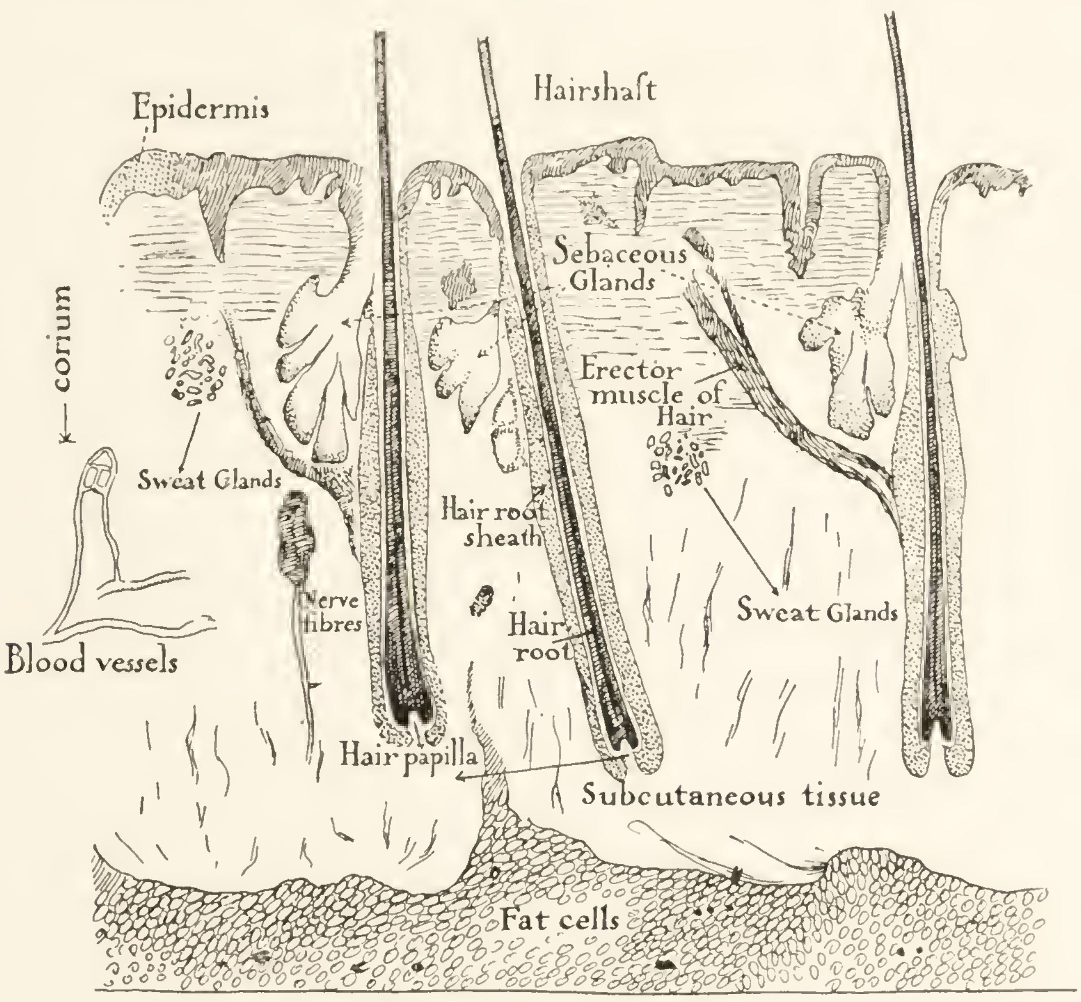


FIG. 24. Cross-section of the human skin.

Swelling and softening of the cells of the horny layer are caused to a much more marked degree by potash and soda lye than by plain water, the potash lye acting more strongly and rapidly than soda. Large quantities of potash are contained in the so-called black or green soap (potash soap) and in the yellow olein soap. Soda lye, on the other hand, enters into the composition of many toilet soaps, and the use of any of these soaps will cause the cells of the horny layer to swell up and soften so that they can be easily removed by rubbing with a towel. Together with the most superficial cells, the dirt adhering to the skin will also come off. In order to cleanse and disinfect the body thoroughly, it is necessary to resort to potash soap from time to time. Neutral or fatty soaps, however, are better for individuals with sensitive skin, particularly since potash soap is frequently manufactured from refuse (see SKIN, CARE OF).

The epidermis contains few blood-vessels. In certain localities, vessels apparently can be seen in the skin, but merely because the epidermis is transparent where it is thin. The red colour of the skin depends upon the

amount of blood in the vessels, as well as upon the thickness of the epidermis. If the vessels are empty, the skin will be pale. A certain degree of thickness on the part of the epidermis is of advantage, since the skin will be less sensitive and will become inflamed less readily.

2. The corium, which can be seen if the epidermis be removed, has upon its surface a number of conical or wart-shaped projections known as the papillæ of the skin. Microscopically, these consist of a densely interwoven network of connective-tissue fibres with many elastic fibres. The latter give the skin its elasticity and permit it to return to its normal condition after it has been raised up in a fold. The corium of some animals plays an important part in the industries, since it is converted into leather by being treated with certain substances rich in tannic acid (specifically, oak-bark).

The corium contains both vessels and nerves. Some of the nerves end in the papillæ by means of peculiar cone-shaped structures, known as the tactile corpuscles, because they are supposed to transmit the tactile sensation. Others penetrate as far as the cells of the Malpighian layer, where they end in small knobs, which probably transmit sensations of pain.

3. The subcutaneous fatty tissue lies directly under the corium, and consists chiefly of connective-tissue fibres in which numerous fat-cells are embedded. The amount of fat present is proportionate to the stoutness of the individual, the layer being very thick in the well-nourished. This can be demonstrated best by picking up a fold of the skin. In many places, however, the skin is always free from fat. The skin of the eyelids and ears invariably contains few fat-cells, and upon the back of the hands and feet the fold of skin raised is always very thin.

The accessory organs of the skin include (1) the Sweat Glands, (2) the Sebaceous Glands, (3) Smooth Muscle-fibres, (4) the Nails, and (5) Hair.

(1) *The Sweat Glands* (see Fig. 24) form long tubes whose blind ends, rolled up in the form of coils, extend downward for quite a distance, and may even penetrate to the subcutaneous fatty tissue. The inner layer of these tubes is generally lined by a single layer of cubical epithelial cells, which secrete the perspiration. In the epidermis their course resembles that of a corkscrew, while their opening upon the surface of the skin is just visible to the unaided eye as a fine point. The perspiration secreted by these glands consists chiefly of water and various salts. There can be no doubt, however, that the sweat glands remove a number of other substances from the body, which cannot always be detected by chemical tests. The marked perspiration noted during the course or at the termination of certain diseases possibly serves to rid the body of certain poisonous principles. Under normal conditions the perspiration merely protects the epidermal cells from drying out, since the spiral portion of the excretory duct no longer possesses definite walls of its own but enters into intimate relation with the cells. The excreted fluid evaporates upon the surface of the skin, thereby removing

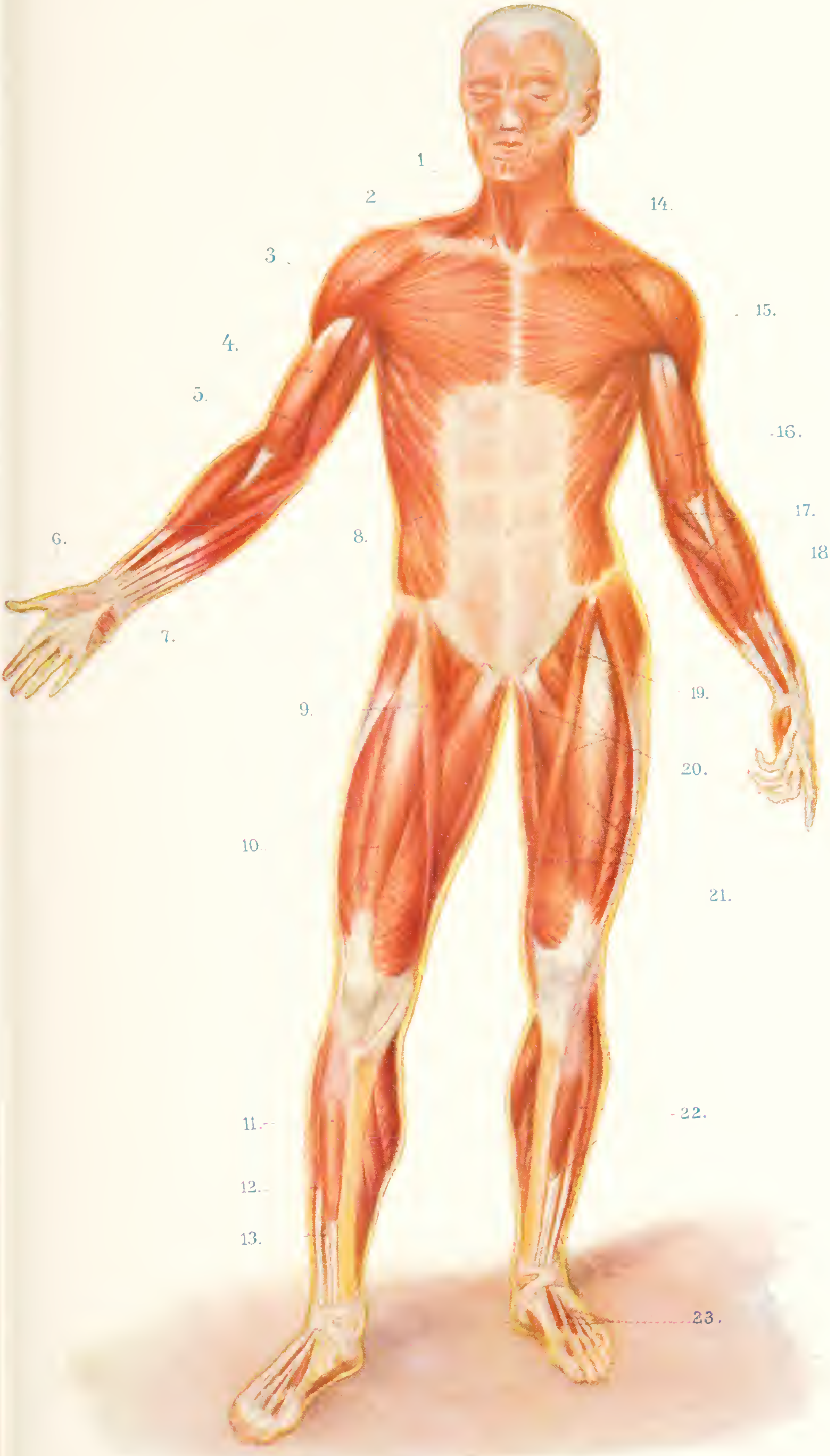
PLATE I.—MUSCLES OF THE HUMAN BODY

(From the front)

1. Sternoclidomastoid
2. Trapezius
3. Pectoralis major
4. Biceps
5. Triceps
6. Abductor pollicis (muscles of thumb)
7. Abductor of little finger
8. External oblique of abdomen
9. Sartorius (tailor-muscle)
10. Quadriceps extensor
11. Anterior tibial
12. Long extensor of toes
13. Long extensor of the great toe
14. Platysma myoides
15. Deltoid
16. Flexors of upper arm
17. Flexors of forearm
18. Extensors of the arm
19. Anterior muscles of the hip
20. Flexors of the thigh
21. Extensors of the thigh
22. Extensors of the foot
23. Lumbrical muscles of the toes

(For description of the functions of the various muscles, see pp. 134-139. See also Index to the Manikin)

Plate I.



considerable warmth from the body. It follows that a cold may be caught most readily after the body has perspired freely.

(2) *The Sebaceous Glands* (Fig. 24) are much shorter, and possess a more acinose (cluster of grape-like) structure, because they widen out at their blind ends. The inner layer is also lined with epithelial cells which secrete a solid and soft, fatty substance known as the sebaceous matter of the skin. This renders the hairs and the surface of the skin supple, and protects against excessive evaporation of water. The inhabitants of certain parts of Central Africa grease their skins with animal fat because the extreme dryness of the air causes an excessive evaporation of water from the skin. Most sebaceous glands lie close to the hairs, so that the latter are anointed by the sebaceous matter even before they have grown out of the skin. The normal gloss of the hairs depends chiefly upon the fat with which they are supplied. Large sebaceous glands without hairs are found in certain localities of the human body, such as the forehead and nose. Excretory ducts, too, are generally filled with sebaceous matter, which readily exudes if pressure is exerted upon the skin. If the skin of the nose be squeezed, a small worm-shaped body will appear at the opening of the sebaceous glands; this body, which is often looked upon as an animal parasite, gives rise to blackheads. If this vermiform body be rubbed up between the fingers, its fatty nature will be evident. The sebaceous glands occasionally become obstructed when inflammation sets in, and the surrounding skin will turn red. The red noses of some individuals are caused by obstructed and inflamed sebaceous glands. It is wise to press out the obstructed sebaceous glands from time to time, after thorough cleansing, when these disagreeable conditions appear.

(3) *Smooth Muscle-Fibres* occur in the human skin about the small blood-vessels, and also as the "erector muscles" (Fig. 24) of the hairs. The smooth muscle-fibres of the blood-vessels have been already discussed. Their contraction diminishes the diameter of the blood-vessels, so that less blood will circulate through the skin, and this will appear pale. Their relaxation increases the supply of blood, and the skin will redden. The erector muscles of the hairs run obliquely from the end of the root of the hair to the line of junction between epidermis and corium. By their contraction the hair is raised and drawn slightly out of the skin. The skin will then appear to be set with small conical projections, forming the so-called "goose-skin." Contraction will readily be brought about by a cold douche, and application of cold water has quite properly been termed a sort of gymnastic exercise for these fibres. The same action results from an "air-bath."

(4) *The Nails* are horny plates which are pushed forward during their growth on very delicate longitudinal furrows of the subcutaneous tissue. The part of the skin which supports the nail is called the "nail-bed"; the horseshoe-shaped furrow into which the edge of the nail fits, the "matrix"

of the nail. The most posterior portion of a normally shaped nail forms a white, crescent-shaped spot. This spot appears white because the blood-vessels of the corium are less numerous there than in the more anterior portions of the nail. A portion of the epidermis generally projects over the white area. Owing to its exposed position, this dries out and cracks easily, giving rise to the so-called "hang-nails." These should not be neglected, since dirt may easily get into the small wounds, giving rise to inflammation of the fingers (see NAILS, CARE OF).

(5) *The Hairs* are merely cornified appendages of the skin. They are derived from epithelial cells of the epidermis, which become horny while still in the deeper layers, and then penetrate the surface. The root of the hair, however, extends down in the corium for quite a distance, and may even approach the subcutaneous fatty tissue. The part of the hair contained in the skin is the root; its free portion, the shaft. In untrimmed hair the shaft ends in an extremely fine point. The lower end of the root of the hair forms a nodular swelling (the bulb of the hair), which is hollowed out like the false bottom of a bottle. In this bulb the proliferations of the epidermal cells take place, which are responsible for the longitudinal growth of the hair. The excavation of the corium which receives the root is known as the hair-follicle. The sheath of the hair-root is the layer of epidermal cells which is continued into the follicle so that it surrounds the hair on all sides like a sheath. If a loose hair be pulled out, the sheath frequently remains adherent to the root in the form of a transparent pellicle which can be easily pulled off. The hair itself consists chiefly of cornified spindle-shaped cells containing a varying amount of pigment in dark hairs. Blond hairs are also pigmented, but the pigment is so finely distributed that it no longer appears in the form of granules. Grey or white hairs either contain no pigment at all, or else are split up owing to the presence of numerous cracks and fissures between the horny cells, which are filled with air. Grey hairs alone are not always a sign of age, since many individuals near thirty are completely grey. The sudden change of colour seen after severe emotions, such as fright, is also due to this splitting (see HAIR, CARE OF).

In the newly-born, the body is covered only by very delicate hairs known as the lanugo hairs. A part of these fall out at an early age and are replaced by permanent hairs, such as are found upon the scalp, the eyebrows and eyelids, the axilla, etc. But the life of these hairs is also limited, since they fall out and are replaced by new hairs. Under normal conditions each hair of the head has a life history of several years. The daily growth is about $\frac{1}{25}$ of an inch, and the ultimate length from $\frac{1}{2}$ to 1 yard. Excessive falling out of the hairs is generally due to an affection of the scalp, or to anæmia. Exhausting infectious diseases such as typhoid may also lead to baldness. The occurrence of isolated spots of baldness here and there is frequently due to parasites in the hair-follicle, the presence of which interferes with the

growth of the hairs (see HAIR, CARE OF). It must be emphasised here that there is no known infallible external remedy to promote the growth of hair, and all claims of this kind are humbug. Frequent cutting of the hair will thicken each individual hair and make it appear fuller, but it cannot increase the actual number. Short hairs also possess the advantage that they and the skin from which they grow can be more readily cleansed.

V.—GENERAL REMARKS ON THE GROSS ANATOMY OF THE HUMAN BODY

The external shape of the human body differs widely with the different races and the members of each race. Although there are doubtless certain definite characteristics for each race, it must not be forgotten that there are well-marked exceptions. Thus, there may be negroes and Japanese with pronounced Caucasian features and remarkably light skin; while on the other hand the white race may include individuals whose faces suggest more the negro type, and whose skin is exceptionally dark.

Compared with the male sex, women are smaller and more delicate, but with more graceful and less angular shape. The neck, which is more slender, gradually passes into the rounded shoulders, while in the man the neck is stouter and is placed more abruptly upon the more angular shoulders. Despite the well-developed breasts, the female chest is more slender and narrow. On the other hand, the central portions of the body (hips and pelvic region) are better developed in women. The buttocks are very prominent and counterbalance the abdomen when it enlarges with pregnancy. The lower extremities are considerably shorter than in men; the difference being most marked in the legs (average two inches). The delicate skin of women is supplied with an abundant deposit of fat, which is responsible for the graceful contours. In the male, the true form is more apparent, and the body is more slender and muscular.

The internal structure of the human body always remains approximately the same, no matter how the external form varies (see Fig. 25). The human body may be compared to two tubes, placed perpendicularly, one in front of the other, when the body is in the upright position. The anterior (so-called vegetative tube) is the wider of the two, and contains the digestive organs. It begins at the mouth and nose and ends at the anus. The respiratory organs (wind-pipe and lungs) also join this tube.

The second, posterior tube lies in the skull and vertebral column, and contains the brain and spinal cord, the high development of which organs is characteristic of human beings as distinguished from the animals. The two tubes, together with their membranes, form the so-called *axis* of the body, in which the following parts may be recognised: (1) *Head*; (2) *neck*; (3) *thorax*; (4) *abdomen*; and (5) *pelvis*. The three last-named are spoken of collectively as the *trunk*. The body itself is supplied on each side with two appendages,

called limbs or extremities, which serve to bring the body into more intimate relation with its surroundings, and permit it to move from place to place. The upper extremities consist of shoulder, upper arm, lower arm, and hand;

FIG. 25. Giant, dwarf, and man of average height.

the lower, of the hip, thigh, leg, and foot. The shoulders and hips are placed between the body and the extremities.

The trunk and extremities are supported by bones, all of which together form the skeleton. The bones are united by joints, ligaments, or sutures, which will be described more in detail later. The bones are surrounded by, and intimately connected with, muscles which are in every way analogous to

the red meat of animals. The chest contains the main organ of the circulatory system, the heart, the contractions of which keep the blood within the body in motion. The large vessels which leave the heart are closed tubes which subdivide like the branches of a tree and enter almost every organ of the human body. Their ultimate branches are so small that they can be seen only under the microscope. A large number of nerves issuing from the brain and spinal cord also reach the organs through openings in the skull and vertebral column. At first they appear as coarse strands, but soon become more delicate, and finally microscopic, like the vessels with which they generally enter the organs, as motor, secretory, or sensory nerves, or as nerves of special sense. A few organs, such as cartilage, the solid substance of the teeth, the lens, and the vitreous humour of the eye, are not supplied with blood-vessels.

In describing the separate organs of the human body, definite terms must be used. The natural position of the body is the upright one, and for purposes of clearness it is here presumed that the thumbs point outward, so that the palms of the hands face frontward. In this position the terms upward (superior), downward (inferior), forward (anterior) and backward (posterior) will not give rise to confusion. If the human body is viewed from in front, it will be evident that it consists of two parts which are alike in every way, but reversed. The plane which divides the body into these two halves is known as the *median plane*. Since both halves are alike, they are termed symmetrical. Most of the organs of the body also occur in pairs ; those which are single (as the heart, liver, stomach, certain muscles, etc.) were double, or at least symmetrical, at a certain early stage of development. Though the body may thus be spoken of in a general way as symmetrical, the fact must not be looked upon as a strict rule. In most right-handed individuals, the right side of the body is more developed than the left, and in the left-handed the opposite holds true. And it is only in very few persons that the two halves of the face are strictly alike. The nose is very rarely placed in the median line, but generally deviates slightly to the left or right. This applies also to the classical statues of antiquity, accurate measurements having shown that the symmetry of both halves of the face is only apparent. From these facts it was quite properly concluded that human beings were used as models in ancient times.

Other terms necessary for a clear description of the human body are *mesial* and *lateral*. Mesial is applied to everything lying close to the median plane ; lateral to everything distant from this. For example, the angle of the eye situated near the nose is spoken of as the *mesial*, the other as the *lateral* angle. The directions toward and away from the middle plane are called respectively the mesial and the lateral direction. The terms *internal* and *external* were formerly used in these senses ; but at present

1 Skull

2 Jaw-joint

3 Vertebral joints

4 Neck-joints

5 Rib-joints

6 Mid clavicle-joint

7 End clavicle-joint

8 Clavicle

9 Acromion process

10 Shoulder-joint

11 Ribs

12 Shoulder-blade (*scapula*)

13 Humerus

14 Breast-bone (*sternum*)

15 Lumbar vertebræ

16 Vertebral joints

17 Elbow-joint

18 Sacrum

19 Hip-bone (*ilium*)

20 Radius

21 Ulna

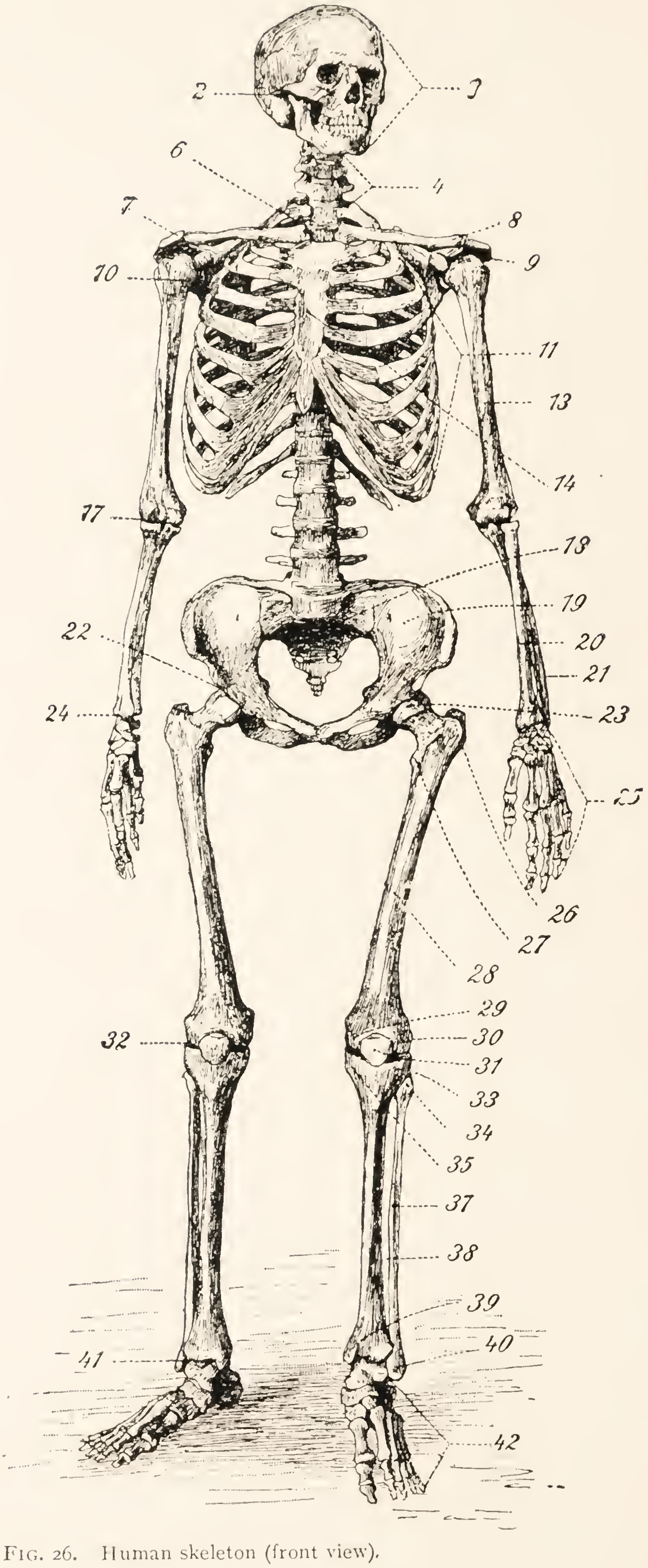
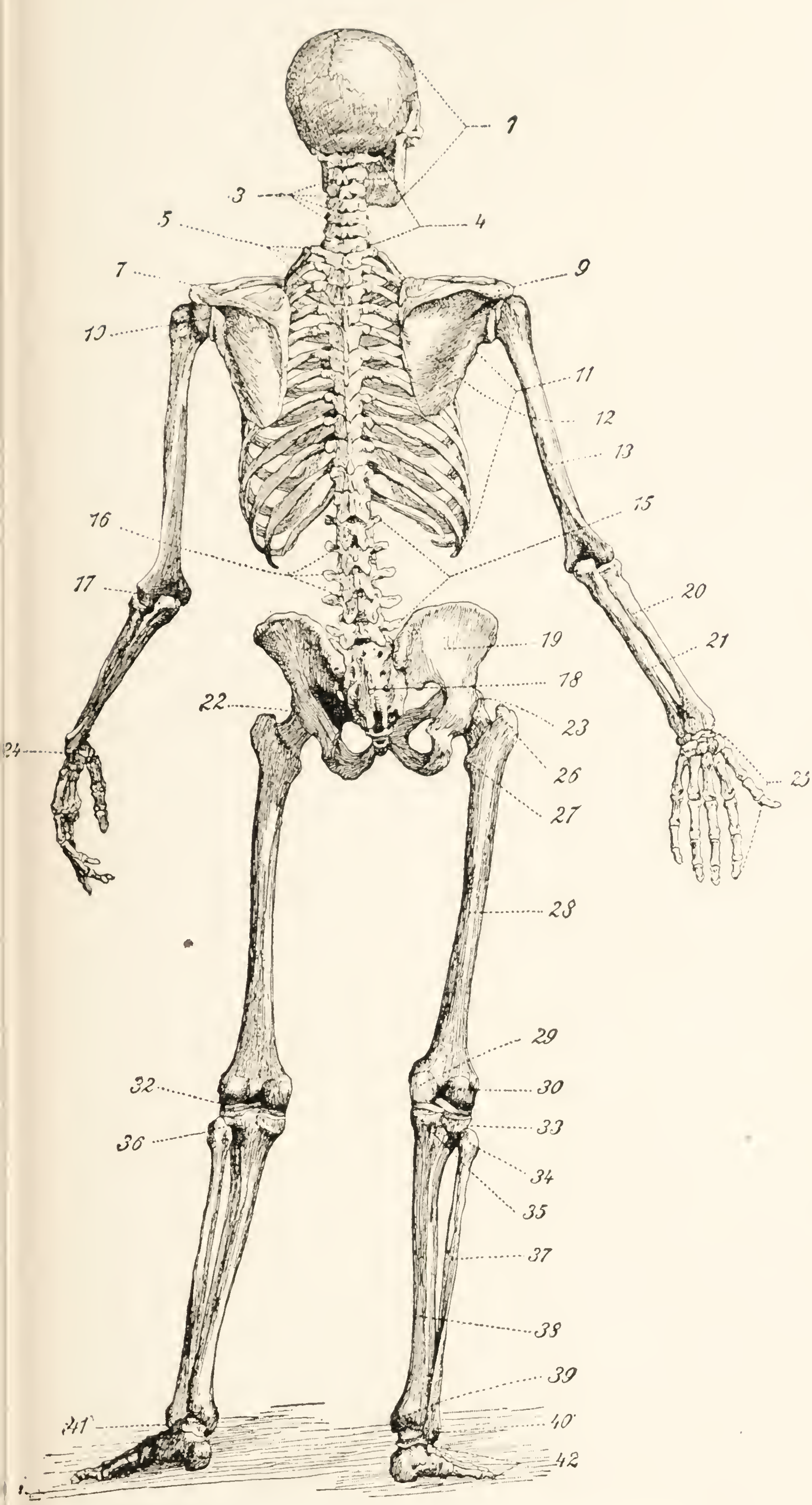


FIG. 26. Human skeleton (front view).



22 Hip-joint

23 Head of femur

24 Wrist-joint

25 Bones of the hand

26 Greater trochanter

27 Lesser trochanter

28 Femur

29 Inner trochanter of femur

30 Outer trochanter of femur

31 Patella

32 Knee-joint

33 Lateral trochanter of tibia

34 Head of fibula

35 Inner trochanter of tibia

36 Superior joint of fibula

37 Fibula

38 Tibia

39 Inner ankle

40 Outer ankle

41 Ankle-joint

42 Bones of the foot

Fig. 27. Human skeleton (back view).

an organ is termed external if it lies nearer to the surface, and internal if nearer to the axis or middle of the body. Thus, the thorax has an *external* surface, covered by skin, and an *internal* one adjacent to heart and lungs.

The organs of the body are generally described in the following subdivisions: (1) *Bones;* (2) *ligaments;* (3) *muscles;* (4) *internal organs;* (5) *vessels;* and (6) *nerves.* Only the fundamental principles will be described in the following chapters.

VI.—BONES

All the bones of the human body taken together form a framework, known as the *skeleton* (see Figs. 26 and 27); and from even a cursory examination of the skeleton it will be seen that the shape of the bones varies considerably. The extremities consist chiefly of long bones which possess a large cavity filled during infancy with red marrow and in the adult with yellow marrow. The short and flat bones have a more spongy structure, and their meshes always contain red marrow. Where the bones enter into a true joint they are always smooth, because they are here covered with an opaque, glassy surface of cartilage, the function of which has already been pointed out. The bones possess many small and large openings, which permit blood-vessels and nerves to enter and leave. Other peculiarities are projections and irregularities of the surface which indicate the sites to which the various muscles are attached. The muscles being generally more developed in the male sex than in the female, the muscle attachment places are more pronounced in the male skeleton. Furthermore, the surface of every bone is covered by a thin, white and shiny layer of tissue (the *periosteum*), which is abundantly supplied with nerves, so that an injury or inflammation, such as may follow a blow on the shins, is exceedingly painful.

The bones are joined to each other by (1) sutures, (2) cartilaginous plates, (3) masses of connective tissue (false joints), or (4) by true joints. Sutures are found only in the skull, where various projections from the edges of the bones fit into each other like the cogs of a wheel. The growth of the various bones which make up the skull goes on at these sutures, and if the latter become ossified prematurely no further growth is possible. At an advanced age most sutures ossify normally, so that it may be difficult to distinguish them. In the second class, two adjacent bones are joined by a layer of cartilage; while in false joints the junction is formed by a mass of connective tissue such as forms the intervertebral discs. In true joints, each of the two bones concerned possesses a covering of cartilage, between which is found a narrow slit (the *synovial cavity*) filled with a small amount of stringy or gelatinous fluid (the *synovial fluid*) which serves to lubricate the joint-surfaces. Further details of this subject will be found under Joints and Ligaments in the succeeding chapter.

1. **The Skull** may be divided into two parts, the *cranium* and the *face*. The bones of the cranium form a box-like enclosure for the brain; while those of the latter form the framework of the face. The strongly-arched upper portion of the entire skull is called the *vault*; the lower, very irregular portion, provided with many projections and openings, is called the *base* of the skull. Many bones (twenty-two in all) enter into the formation of the skull, and only the most important ones can be mentioned here. The vault is made up in front of the frontal bone; above and in the middle

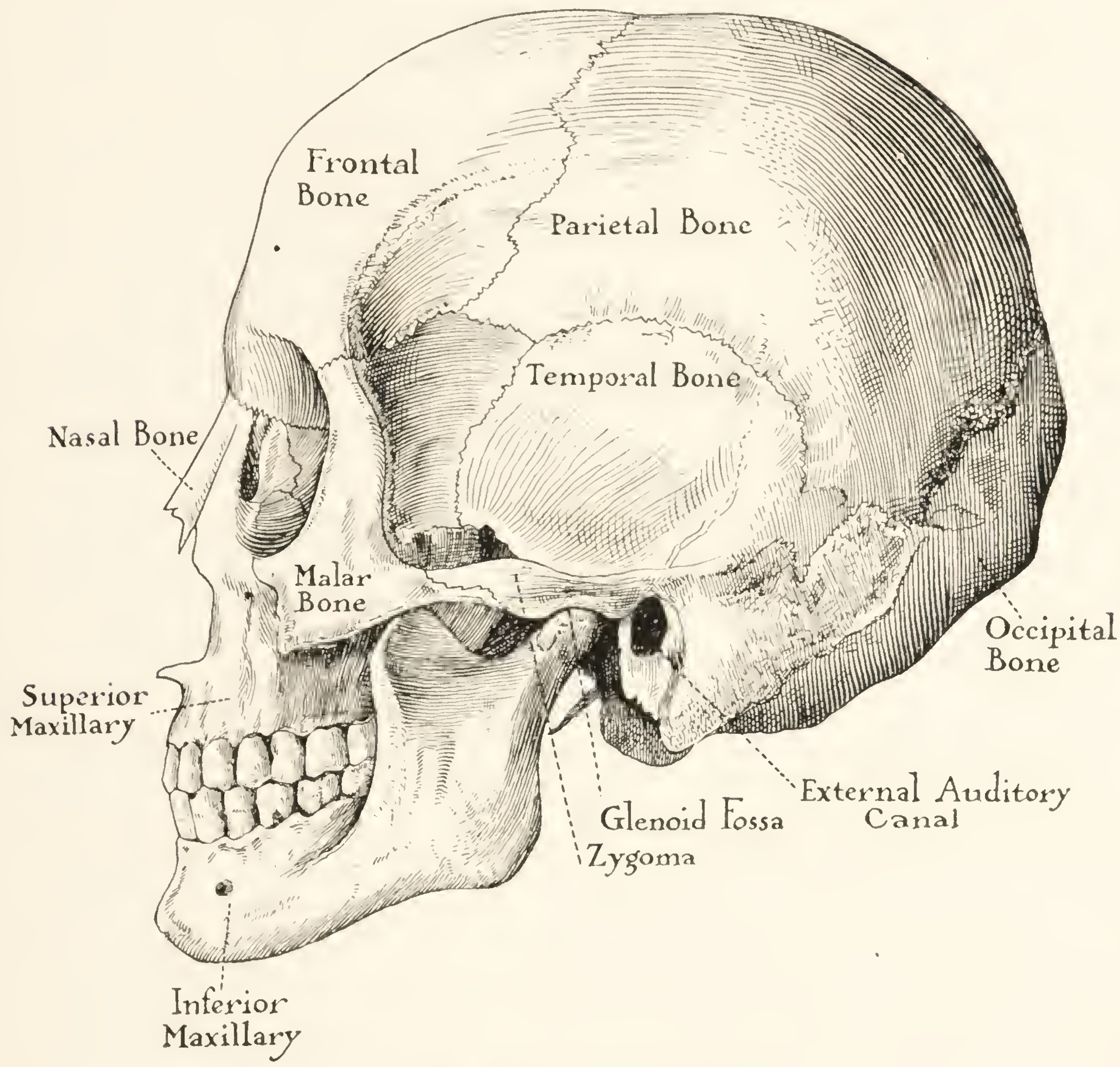


FIG. 28. Bones of the adult skull.

of the two parietal bones; and behind of the occipital bone, which also forms the most posterior portion of the base. A large rounded opening (the *foramen magnum*) is found here, through which the spinal cord passes into the skull to merge in the brain. The lateral walls of the skull are formed chiefly by the temporal bones, on the sides of which are the openings leading to the inner mechanism of the ear. Behind this is a projection pointing downward, which is known as the *mastoid process*, and which gives attachment to the strongest muscle of the neck, the *sternoclidomastoid*. The mastoid process contains a number of cavities which communicate with the middle ear. A purulent inflammation in the middle ear frequently spreads to these cavities, so that an operation may be necessary to open them.

Two prominent bones of the face are the *malar bones*, which are placed by the side of the orbits and communicate with the temporal bones by means of a narrow arch of bone, the *zygomatic arch*. The malar bones are generally spoken of as the cheek-bones. The two nasal bones form the bony framework of the nose and partly give it its shape. Beneath the nasal and malar bones is the upper jaw, which constitutes the greater part of the facial skeleton, and which contains the upper teeth. The lowermost portion of the face is formed by the lower jaw, which consists of a horseshoe-shaped middle piece (the *body*) from the ends of which two branches extend upward. These branches possess articular processes which connect with the temporal bone by means of the *temporo-maxillary joint*. If the skull be viewed from in front, the two orbital cavities for the eyes and their accessory parts will be very pronounced. Between these is the nasal cavity, which, by means of a partition, is divided into two halves, called the left and right *nasal fossa*. Three shell-like processes, the turbinate bones of the nose, project from the lateral wall of each nasal fossa. The floor of the nasal cavity is formed by the hard palate.

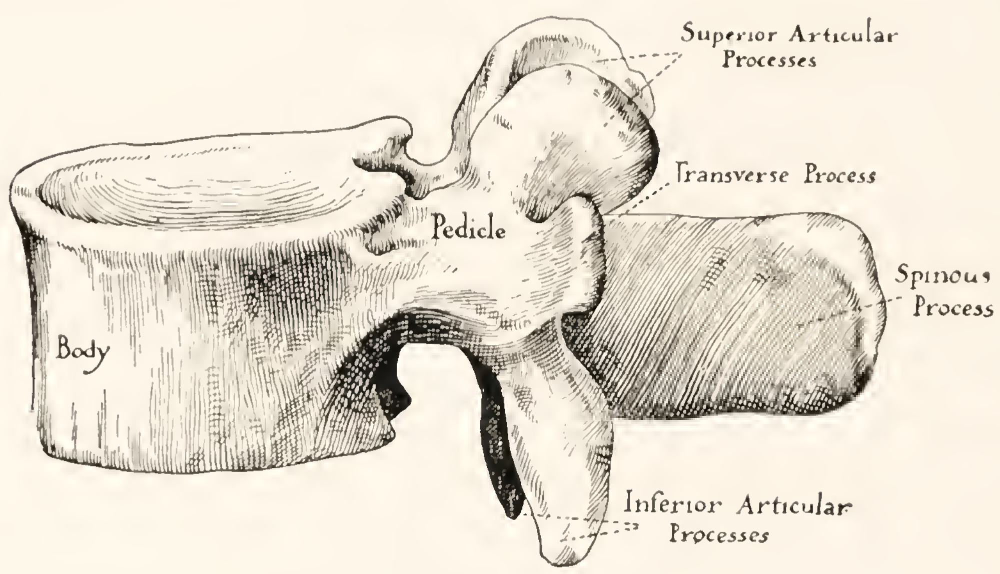


FIG. 29. Side view of a spinal vertebra.

2. The Vertebral Column may be regarded as a long tube, the transverse sections of which present a more or less rounded appearance. It is made up of a number of separate ring-like bones, the *vertebræ*. According to their position, these are described as (1) seven *cervical vertebræ*, (2) twelve *dorsal vertebræ*, (3) five *lumbar vertebræ*, (4) five *sacral vertebræ*, and (5) four or five *coccygeal vertebræ*. The twenty-four upper vertebræ (cervical, dorsal, and lumbar) are known also as the *true vertebræ*, because they are connected with each other by means of joints and ligaments. The five sacral vertebræ are united to form one single bone, the *sacrum*, to which is connected the *coccyx*, an appendage made up of the consolidated four or five coccygeal vertebræ. This coccyx corresponds to the tail of animals.

Every true vertebra consists of an anterior, prominent portion (the *body*), and a posterior, narrow arch (see Figs. 29 and 30). The body and arch together enclose the orifice for the spinal cord and its membranes. The following processes arise from the arch : (a) the *spinous process*, pointing backward and easily felt through the skin ; (b) two *transverse processes* directed outward ; and (c) four *articular processes*, two of which are

directed upward and two downward. The last-named processes serve to form small accessory joints between adjacent vertebræ. The dorsal vertebræ possess also small articular surfaces to which the ribs are fastened. Among the cervical vertebræ, the uppermost one, the *atlas*, has a peculiar shape, which enables it to turn with the head around a special process of the second vertebra, known as the *odontoid process*. The lowermost portion of the vertebral column (the so-called *false vertebræ*) is formed by the sacrum, a triangular piece of bone, the broad, upper portion of which abuts against the last lumbar vertebra, while its apex is directed downward. Its front and back surfaces contain a number of large openings which serve as passages for vessels and nerves. The lateral surfaces of the sacrum are connected on each side with the hip-bone. The coccyx is attached to the apex of the sacrum and hangs downward. All three bones together form the *pelvis*, to be described later.

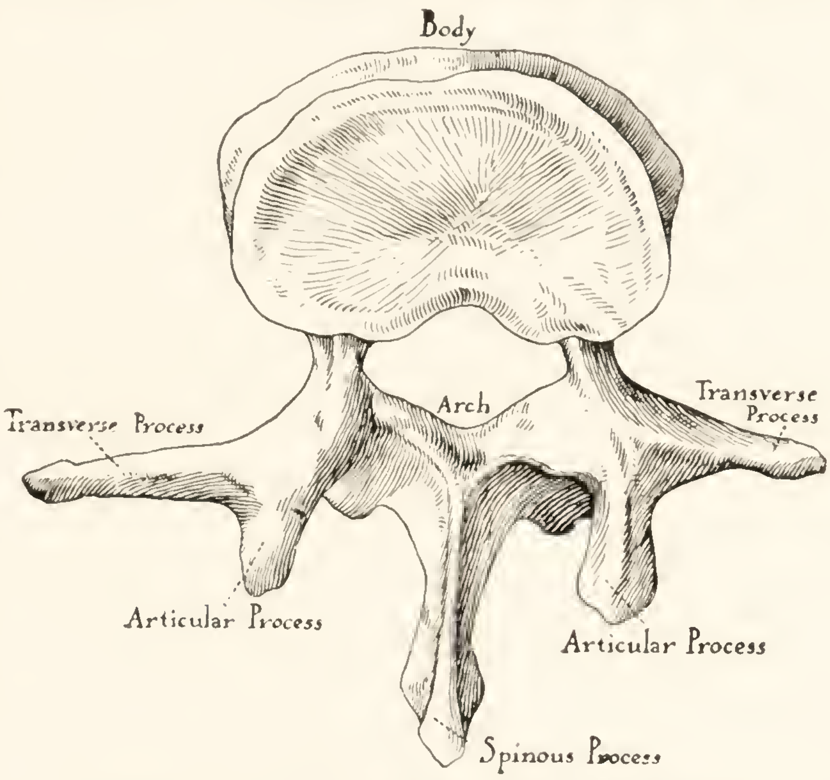


FIG. 30. A spinal vertebra seen from above.

Viewed from the side, the vertebral column presents four distinct curves (see Fig. 31). The cervical portion is convex anteriorly, the dorsal portion concave, the lumbar portion convex, and the sacral and coccygeal portion, again, concave. These curves are not present in the newly-born, but develop during the first years of life. The cervical curvature makes its appearance when the infant begins to hold up its head. The dorsal curve is a result of its attempts to sit, and in weak children it may be exaggerated to a hunch. Walking in the upright position gives rise to the lumbar curve; and the sacral curve is probably formed coincidentally with development of the pelvic organs. All the curves become more pronounced if heavy weights are carried upon the head or shoulders. A crouching posture may cause the entire vertebral column to become concave anteriorly; but, on lying down, the curves almost entirely disappear, so that the vertebral column becomes straight and elongated, sometimes to the extent of an inch. A person getting up from bed after a long sickness may indeed be taller, because his vertebral column has straightened.

All the changes described in the foregoing depend upon the normal mobility of the vertebral column. Disease may, however, affect the bones, so that permanent, abnormal curvatures will follow. The best-known of these is the lateral curvature of the spine (see Part II. *s.v.* VERTEBRAL COLUMN, CURVATURES OF), which is either the direct result of the improperly constructed desks found in so many schools, or else is due to the

fact that many school children carry their heavy books invariably in the same hand. Usually this condition is not recognised until one shoulder is higher than the other. Parents should carefully watch for this symptom and should consult a physician in time. The so-called *hunch* is a kinking or curvature backward, which also, as a rule, is due to a disease of the spine. Unless treated early, it will lead to permanent disfigurement.

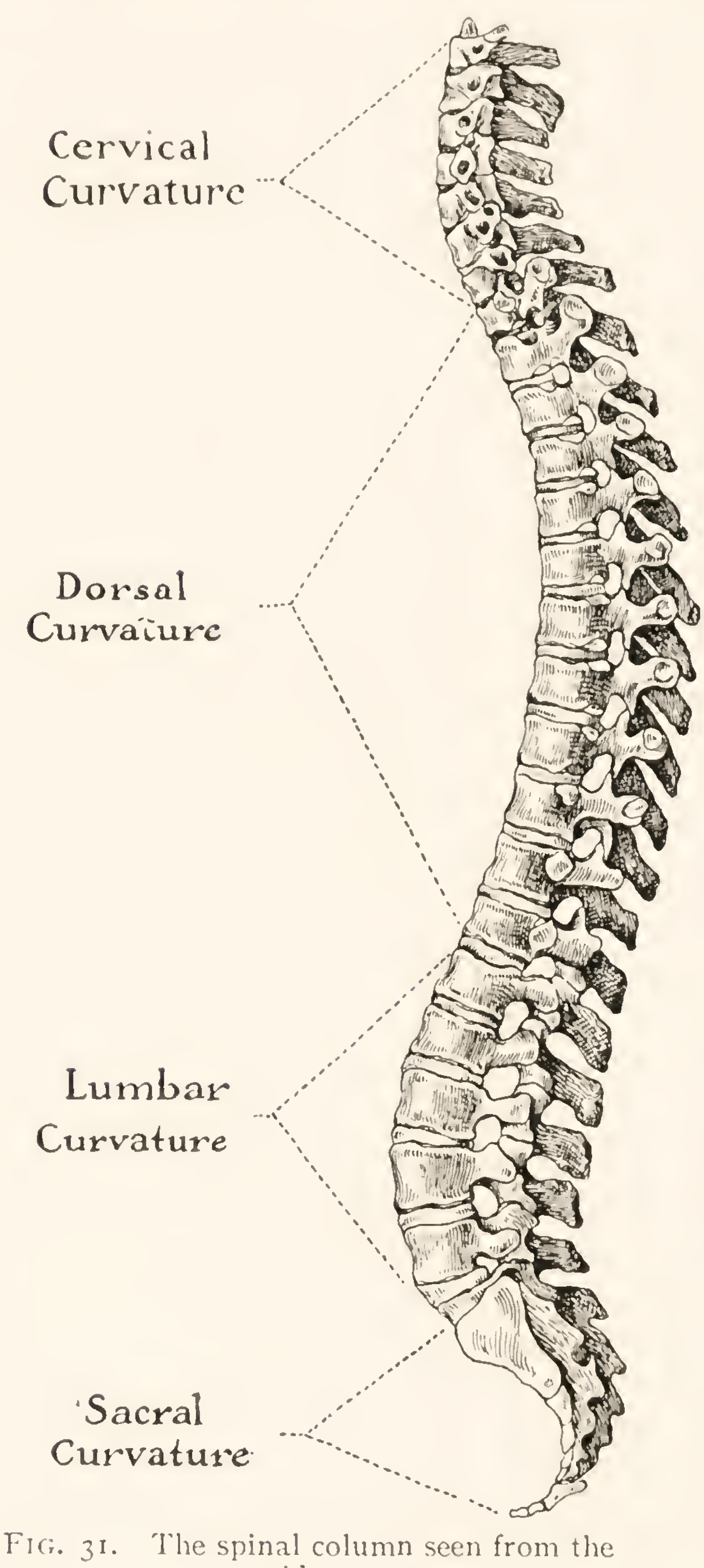


FIG. 31. The spinal column seen from the side.

3. The Thorax is a large cage for the heart and lungs. It is composed of the twelve dorsal vertebræ, together with the twenty-four ribs (twelve on each side), and the sternum. The *sternum* appears as a long, narrow bone, which forms the most anterior portion of the chest, and which can be readily felt under the skin. At its two upper angles it is connected with the two clavicles, and by means of its lateral edges with the seven upper ribs. These seven ribs are therefore called the *true ribs*; the five lower ones, the *false ribs*. The two lower of the false ribs are very short, and their front ends lie free in the abdominal wall; hence, they have also been termed *free ribs*. Behind, every rib is connected with the corresponding vertebra through the agency of two small joints. Every rib consists of an anterior small portion, the *costal cartilage*, and a posterior, large one, the *rib proper*. The elasticity of the costal cartilages greatly facilitates the expansion of the thorax during respiration. If the thorax be viewed from the front, an angle, known as the *costal angle*, will be noticed at the lower end. In this place may be seen in lean individuals a depression in the abdominal wall, known as the *epigastric fossa*, behind which are placed the stomach and part of the liver. By some people this region is erroneously associated with the heart; probably because the pulsations can be felt here during increased activity of the latter organ.

The shape of the thorax is not the same in the two sexes. In the male sex it is cone-shaped; that is, narrow above, and wide below. In women it is narrow above, broad in the middle and again narrow below, the narrowing of the lowest portion being almost always a result of tight lacing from

corsets or other female apparel (see Figs. 32 and 33). In women who have laced very tightly, one may even find the ribs kinked, turned downward and bent together in front. The so-called *chicken-breast* is sometimes seen in indivdiuals who were rachitic during childhood. It is characterised by a marked forward projection of the sternum, and by a depression of the costal cartilages. Individuals with a tendency toward consumption often

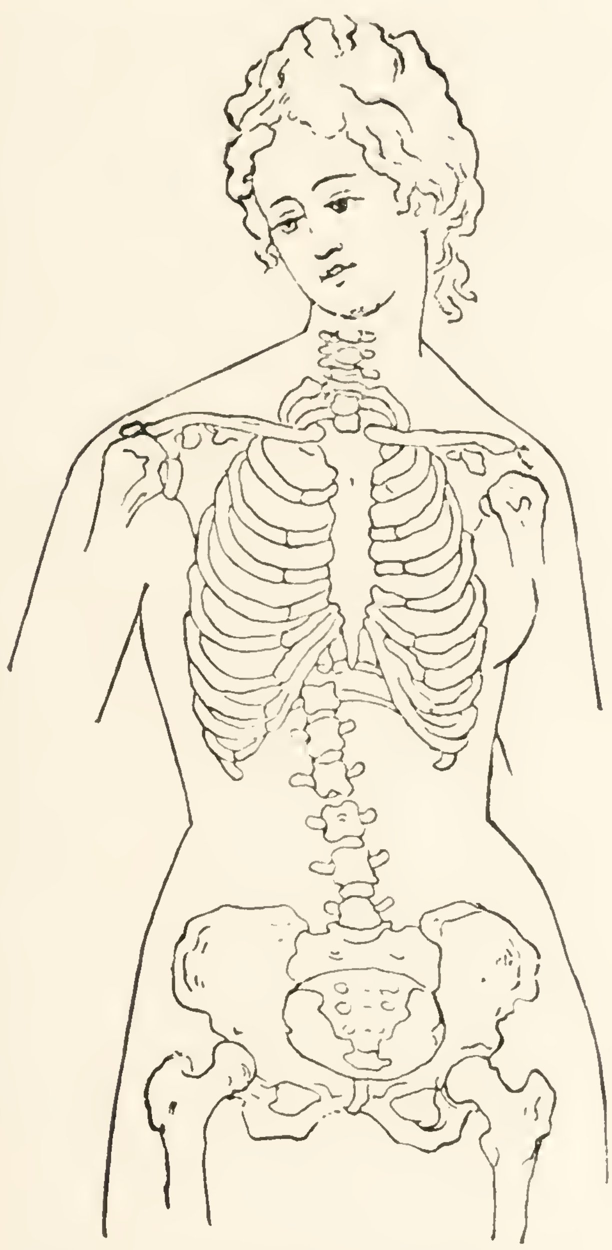


Fig. 32. The chest and waist in the healthy woman.

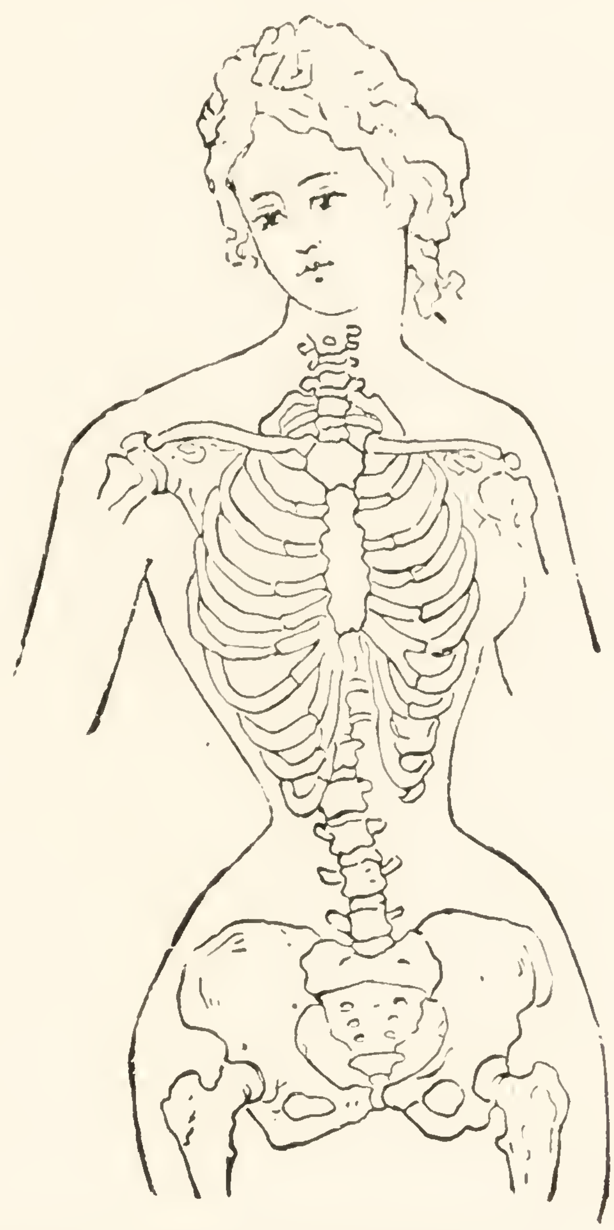


Fig. 33. Chest and waist deformed by tight corset lacing.

possess a long, narrow, and flat thorax ; while those whose vocation requires frequent and deep respirations (labourers, mountain guides, etc.) generally have a short, broad, and deep (so-called "barrel-shaped") thorax. See Plate XVII.

4. The Upper Extremities consist of the following bones : (1) The *clavicle* or collar-bone, (2) the *scapula* or shoulder-blade, (3) the *humerus*, (4) the two bones of the forearm (*radius* and *ulna*), and (5) the twenty-seven bones of the hand (see Figs. 26 and 27).

The clavicle forms a sort of support placed between the thorax and the shoulder ; and it may, therefore, break if one falls on the hands. The bone is always curved slightly ; its mesial end is related to the upper corner of the sternum, its lateral end to the projecting outer portion of the shoulder-blade, the so-called *acromion*. The entire clavicle

can be readily felt through the skin, so that fractures may be easily diagnosed.

The scapula is a flat, triangular bone, whose front surface rests against the back surface of the thorax. A prominent process, the spine of the scapula, projects from its back surface, and throughout its entire course it can be felt under the skin. Laterally, and in front, this spine ends in a flat process, the *acromion*, which stands in relation to the clavicle. The bone has three angles: two above and one below. The upper lateral angle corresponds to the articular surface, which, together with the upper end of the humerus, forms the shoulder-joint.

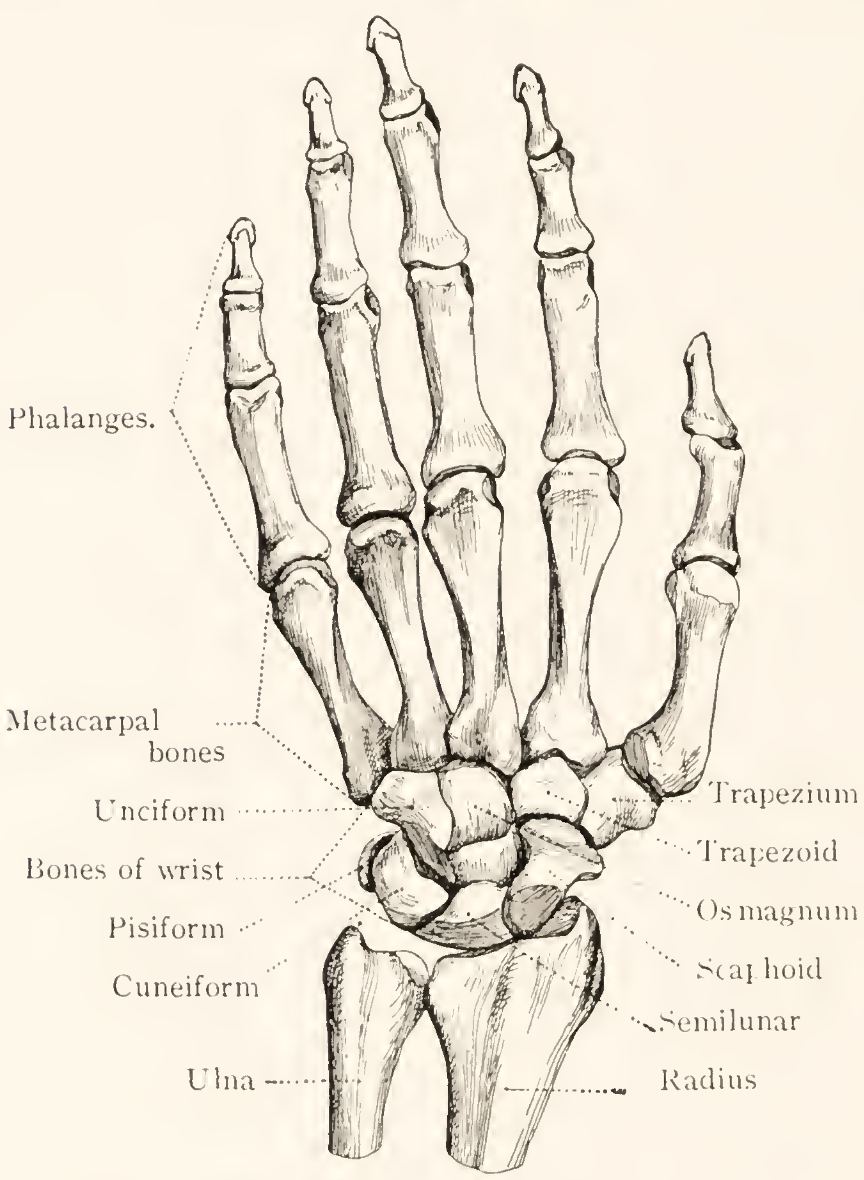


FIG. 34. The bones of the hand from the back.

The humerus is a hollow bone the upper end of which possesses a hemispherical protuberance, the *head* of the humerus, which articulates with the joint-surface of the scapula. The long, central portion is known as the *body*. The lower end is more triangular and comes into contact with the two bones of the forearm by means of a layer of cartilage. The two prominent corners, easily felt under the skin, are the mesial and lateral *condyles* of the humerus.

The bones of the forearm are two in number, the one corresponding to the side of the thumb being termed the *radius*; the second one, on a line with the small finger, the *ulna*. At its upper end the ulna presents a hemispherical hollow into which the humerus fits. The uppermost portion of the ulna behind this hollow bone is the elbow or olecranon process. Throughout its entire course the ulna may be felt under the skin, while the greater part of the radius is covered by muscle, so that only the lower end is accessible to the examining fingers.

The hand (see Fig. 34) is divided into three parts: (1) The root; (2) the middle portion; and (3) the fingers. The *root* of the hand is made up of eight small bones of different shape; four of these form an upper row and four a lower one. Passing from the side of the thumb, the four

bones of the upper row are termed, according to their shape, the *scaphoid* bone, *semilunar* bone, *cuneiform* bone, and *pisiform* bone; those of the lower row, the *trapezium* bone, *trapezoid* bone, *os magnum*, and *unciform* bone. The *middle portion* of the hand consists of the five *metacarpal* bones. Of the *fingers*, four are made up each of three bones or *phalanges*; while the fifth, the thumb, consists of only two phalanges, the middle one being absent. The root and central portion form the real, firm support of the hand, while the fingers possess considerable mobility.

5. The Lower Extremities include the following bones: (1) The *hip-bone*; (2) the *femur* or thigh-bone; (3) the two bones of the leg (*tibia* and *fibula*); and the bones of the foot (see Figs. 26 and 27). In early life the hip-bone consists of three distinct and separate bones, the *ilium*, *ischium*, and *pubis*. The ilium forms the upper excavated portion, known also as the *iliac fossa*. The ischium and pubis enclose an oval opening, which is covered by a membrane. The lowermost portion of the ischium is the *tuber ischii*, which supports the weight of the body when in the sitting posture. The two pubic bones are united in front by means of the pubic symphysis. Below this is the pubic angle, which is more rounded in the female than in the male.

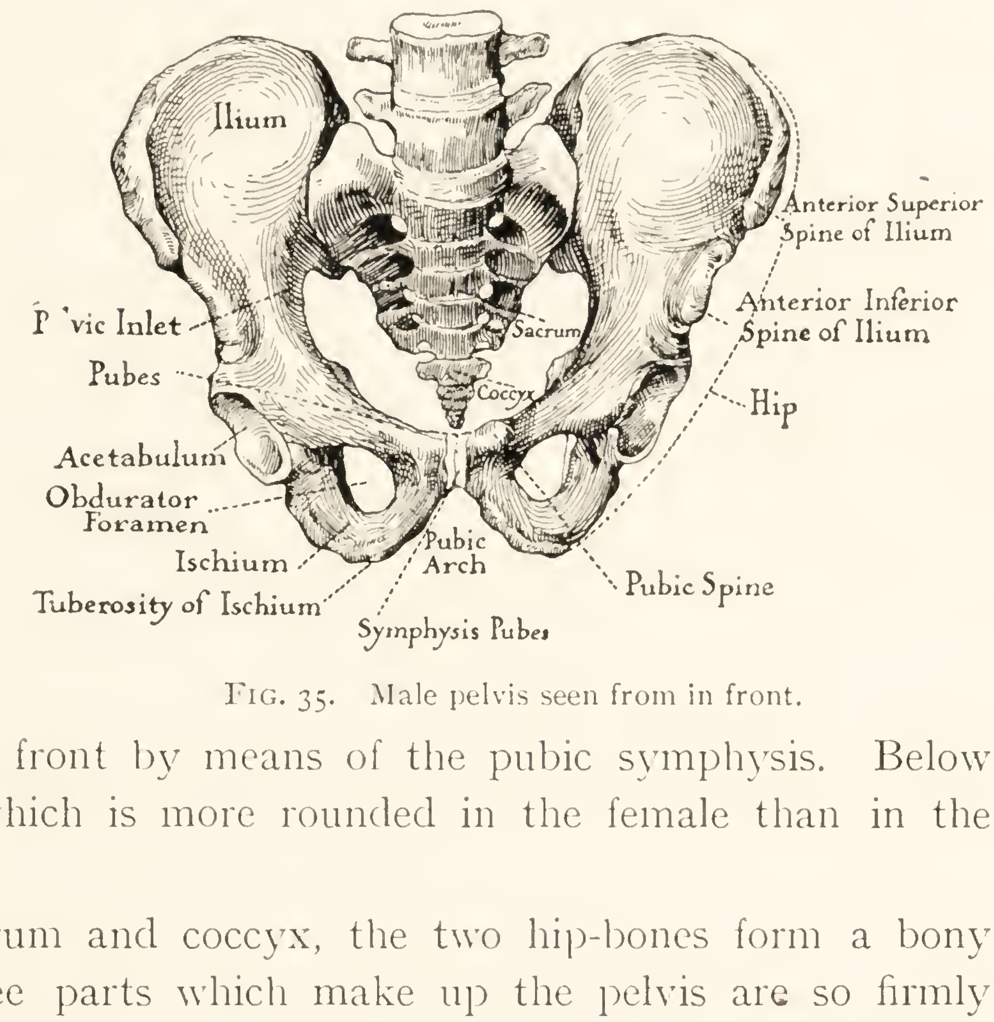


Fig. 35. Male pelvis seen from in front.

Together with the sacrum and coccyx, the two hip-bones form a bony ring, the *pelvis*. The three parts which make up the pelvis are so firmly united that only slight mobility is possible. The pelvis as a whole may be said to consist of two parts, the true and the false pelvis. The true pelvis is situated between the two iliac fossæ, and is open in front; it is separated from the false pelvis by a curved line, the *iliopectineal line*, which marks off the inlet of the pelvis, an opening which is rounded in women but more heart-shaped in men. The portion of the pelvis beneath the inlet is the *false pelvis*; and the opening limiting this below, the *outlet* of the pelvis.

The male and female pelves differ considerably; in fact, the difference between the male and female skeleton is most prominent here. All diameters of the female pelvis are larger; the inlet is more rounded, and the pubic angle more curved. The expanded portion of the ilium is steeper in man; while in the woman it is more flat and, hence, placed further

outward, which explains why the hips are more prominent in the female sex.

The femur is the strongest hollow bone of the human skeleton. Its upper, ball-shaped end, known as the *head*, joins the central portion, or *body*, at an obtuse angle by means of the *neck*. At this locality there are two large protuberances, of which the lateral is called the great, the mesial the small *trochanter*. To these processes are attached almost all the muscles which turn the thigh in or out (around its long axis). The lower end of the femur terminates in two prominences, the mesial and lateral tuberosities of the femur, which, together with the patella and the tibia, form the knee-joint. The *patella* is a triangular bone which is placed entirely within the tendon of a strong muscle (the *quadriceps extensor* ; see Fig 45). The upper ends of the femur are considerably further apart than the lower, so that the legs of every human skeleton are x-shaped.

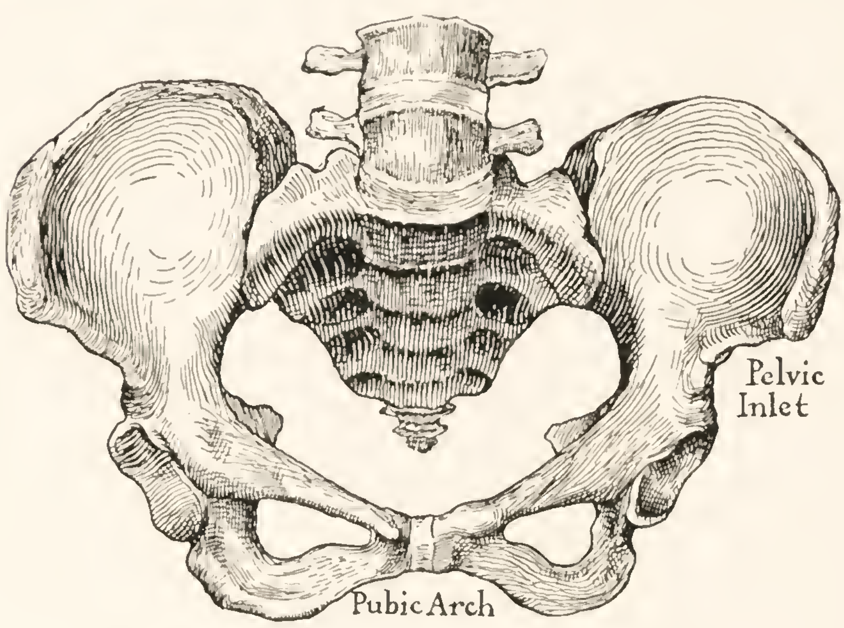


FIG. 36. Female pelvis seen from in front.

The two bones of the leg are termed *tibia* and *fibula*. The former is the larger, and its sharp edge (the *shin*) is located just beneath the skin and therefore much exposed to injury. The upper end of the tibia presents two prominences which, in harmony with those of the femur, are called the mesial and lateral tuberosities of the tibia. The central portion is the *body* ; and the lower end shows a blunt prominence (the *mesial condyle*) which points downward. The fibula is a very slender bone, whose upper end, the *head*, does not enter into the knee-joint. Its central portion, the *body*, is covered by muscles ; its lower end forms a more prominent process, the *lateral condyle*, which also points downward. Both condyles form a depression which receives the uppermost bone of the foot, the *astragalus*. Both the upper and the lower end of the fibula can be easily felt through the skin.

The bones of the foot (Fig. 37) are divided like those of the hand into three classes, viz. : (1) The root of the foot, or *tarsus* ; (2) the central portion of the foot, or *metatarsus* ; and (3) the *toes*. The root forms the most posterior portion of the foot and includes seven short bones, viz. : the *astragalus*, the *calcaneum*, and the *scaphoid*, *cuboid*, and three *cuneiform* bones. The astragalus occupies the highest position, and forms a joint with the fork formed by the two bones of the leg. It rests upon the calcaneum, the most prominent bone of the foot, which also forms the back of the heel. The bones of the tarsus are joined with those of the metatarsus, which

latter correspond to the metacarpal bones, but exceed them in length. The toes have exactly the same number of phalanges as have the fingers; and the terms first, second and third phalanx are applied to the different joints. Like the thumb, the great toe lacks the middle segment. All the phalanges of the toes are considerably shorter than those of the fingers, and are often imperfectly developed. In the hand, the third or middle finger exceeds the others in length; but in the foot, the second toe is the longest.

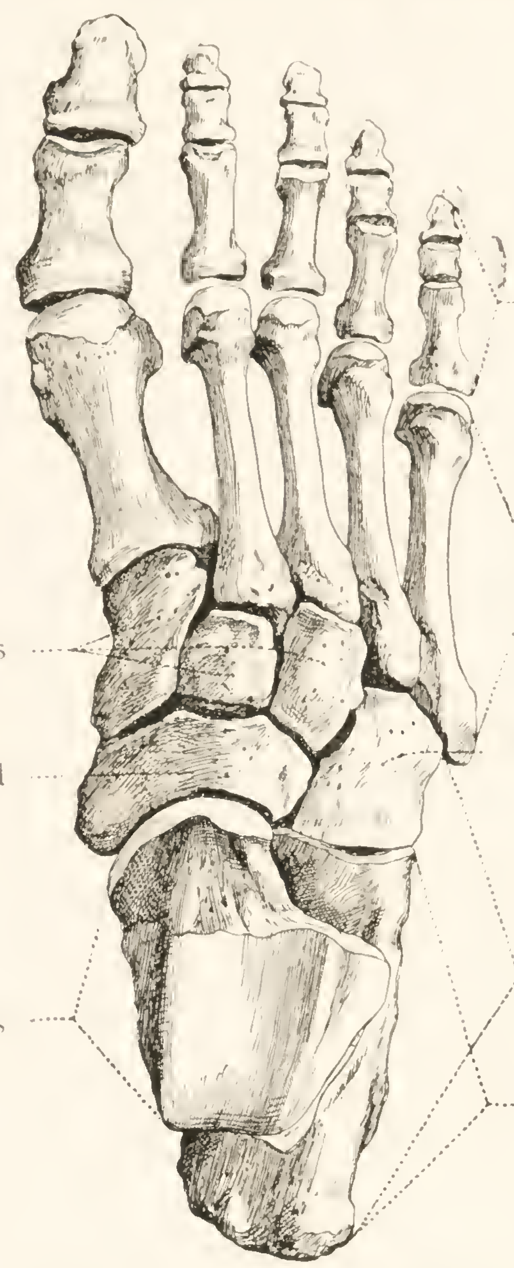


FIG. 37. The bones of the foot.

Deformities of the lower extremities are very frequent, because their bony framework is not always strong enough to carry the weight of the body. Such deformities as x-shaped legs (*bandy legs*), or o-shaped legs (*bow legs*) frequently persist in adult age. They are often seen in individuals who at an early age have been forced to carry heavy weights or to stand much on their feet (as blacksmiths, waiters, etc.). In bakers, one limb is often normal, while the thigh and leg of the other limb form an obtuse angle directed outward. This is caused by the peculiar position assumed when bread is placed in the oven; and the deformity may involve the right or left limb, according to which hand is used. Most deformities, however, result from rachitis during the first years of life (see Part II. *s.v.* RACHITIS); but if the curvature during childhood is not severe, it may disappear as the child grows up. Deformities also frequently affect the skeleton of the foot owing to improper boots. Shoes with high heels and pointed toes are most injurious, the weight of the body crowding the toes into the pointed end, so that they may even be caused to overlap each other. The great toe shows the effects more than the others, and generally deviates strongly toward the side of the small toe.

Other common deformities are *flat feet* and *club feet*. The normal skeleton of the foot forms an arch, so that the inner border of the foot appears hollow and the foot rests upon the heads of the metatarsal bones and the posterior end of the calcaneum (heel). In *flat feet* (see Figs. 38 and 39)

a b c d

FIG. 38. Foot impressions. *a*, normal foot outline; *b*, *c*, *d*, flat-foot impressions.

the entire sole, including the inner edge, rests upon the ground. In *club feet* all the bones are under-developed and forced together into a club-shaped mass; this condition is generally congenital.

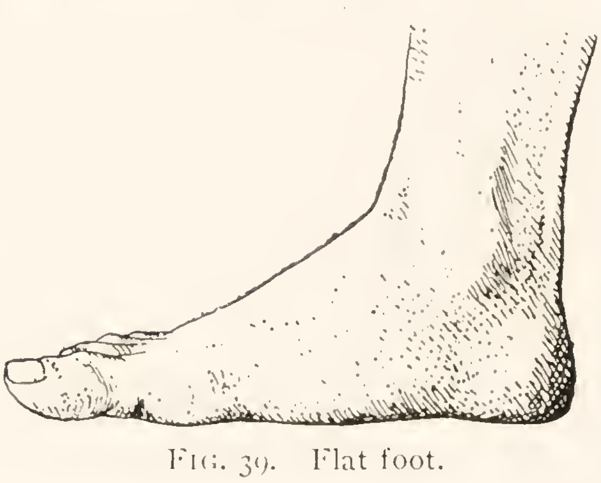


FIG. 39. Flat foot.

VII.—JOINTS AND LIGAMENTS.

It has already been shown (p. 120) that two bones which enter into a true joint (see Fig. 40) are covered with cartilage where they press against one another. A small amount of glairy fluid (the *synovial fluid*) is found between the two cartilaginous surfaces, and serves to lubricate them. Under normal conditions, the quantity corresponds to the amount of oil necessary to lubricate two parts of some machinery which move upon one another. The slit which contains the synovial fluid is known as the *synovial cavity*, and is closed off from the outside by means of the joint-capsule, which is smooth inside and fibrous outside, and which encloses the two ends of the bones like a sheath. Occasionally, however, a larger quantity of fluid accumulates in the synovial cavity, causing the joint surfaces of the bones to separate and the synovial membrane to swell. The tearing of a ligament may cause blood to flow into the synovial cavity and fill it. In inflammation of a joint, the synovial cavity may contain a large amount of watery (really albuminous) fluid, or a yellowish, purulent matter. Aside from the pain caused by the presence of this fluid, the activity of the joint is seriously impaired.

The motions possible in a normal joint depend to a great extent upon the shapes of the joint-surfaces, which vary considerably in the human body. The freest motion of all is possible in ball-and-socket joints in which one surface corresponds to the section of a hollow sphere, the other to that of a

solid sphere. The ball-and-socket joints of machinery are also capable of motion in every direction. In hinge-joints, the joint-surfaces possess a cylindrical shape and the motion is similar to the opening and closing of a knife. Of the various other varieties of joints mention shall be made only of those with level surfaces, in which only slight motion is possible, because the bones can be displaced but slightly in a lateral direction. Another factor which determines the mobility of a joint is the condition of the capsule. If the latter is relaxed and easily stretched, the joint may become so loose that the bones move to and fro; and individuals whose joint-capsules are excessively stretched are frequently exhibited in cheap shows. Lastly, the mobility of a joint depends also upon the accessory ligaments present. These are either very dense portions of the capsule itself, or else are placed external to the latter in the form of prominent masses of connective tissue which run between two bones. On stretching, these ligaments soon become tense, thereby preventing too great a separation of the bones. In certain joints the interior of the synovial cavity is likewise supplied with such bands. The most important joints of the human body are the following:

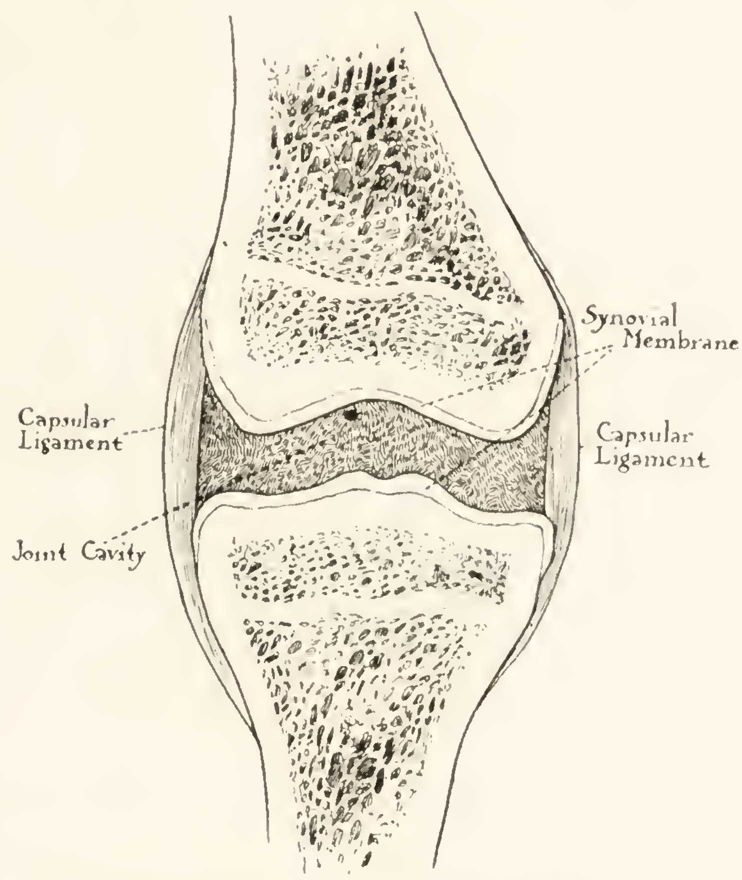


FIG. 40. Long section through a joint. The cavity is much magnified.

1. **The temporo-maxillary joint** is an articulation between the condyle of the lower jaw and the articular surface of the temporal bone of the skull (see Fig. 28). The chief motions are upward, downward and laterally. When the mouth is opened very widely, the articular surface of the lower jaw slips out of the glenoid cavity in the temporal bone with a forward motion. This can be easily demonstrated by placing the finger in front of the ear while opening the mouth. Yawning, or a severe blow on the lower jaw, may cause the articular surface to be displaced forward so far that the mouth cannot be closed again without medical assistance.

2. **The joints of the vertebræ** are situated between the articular surfaces of the different vertebræ. In addition to these, the vertebræ are connected also by the invertebral discs and certain accessory bands which are placed between the adjoining bones. The lateral rotation of the head takes place in the so-called *odontoid* joint, located between the odontoid process of the second, and the arch of the first cervical vertebra.

3. **The articulations of the ribs** are divided into *anterior* and *posterior* joints. The anterior or *costosternal* articulations are placed between the

anterior ends of the seven true ribs and the sternum. Posteriorly, the ribs are connected with their corresponding vertebræ by means of two small joints. All these joints permit the raising and lowering of the ribs during breathing.

4. The joints of the upper extremities include various articulations. The clavicle is in relation with the sternum and the acromion by means of the *sternoclavicular* and the *acromioclavicular* articulations respectively. The former permits the raising and lowering of the shoulder, as well as its forward and backward movements; while the motions of the shoulder-blade are carried out in the latter. The *shoulder-joint* (see Fig. 41) is placed between the articular surface of the scapula and the head of the humerus, and being a ball-and-socket joint it permits of free motion in every direction. Upward motion beyond the horizontal plane is, however, impossible, because the humerus easily presses against the acromion. If it is desired to raise the arm still higher, the shoulder must be rotated so that its lower angle moves outward. Other arm motions possible in this joint are movements away from and toward the body, forward and backward movements, and inward and outward rotations.

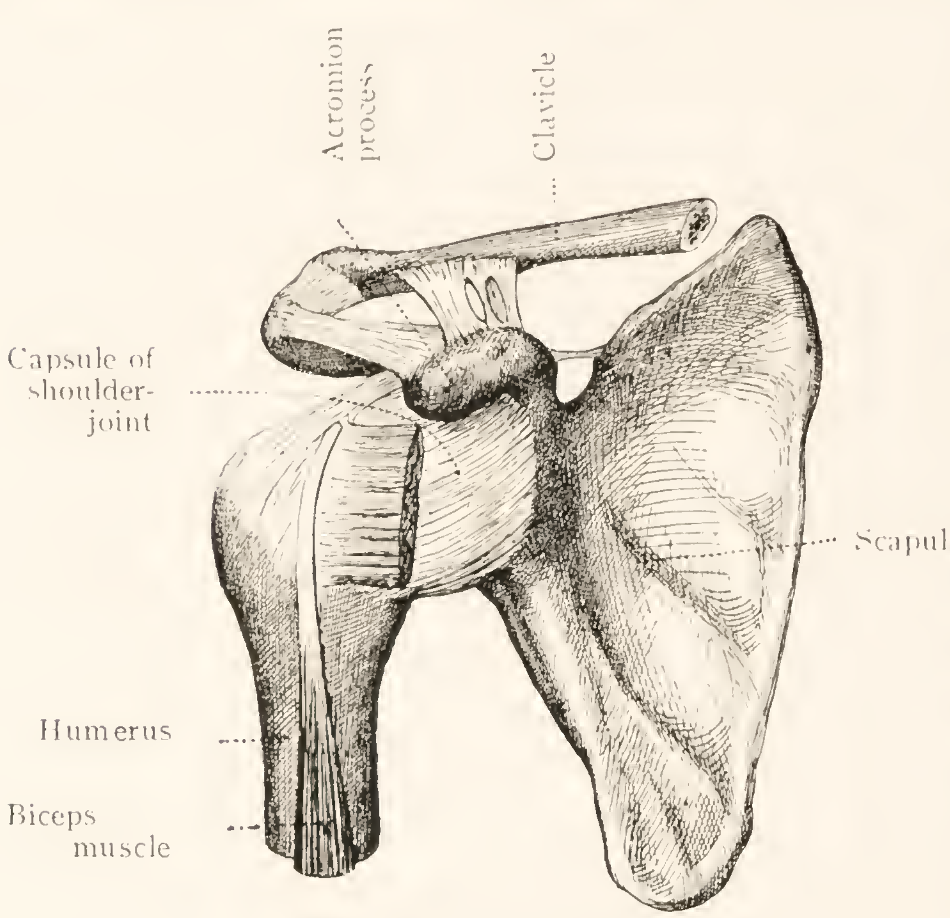


FIG. 41. The shoulder-joint.

The elbow-joint (see Fig. 42) is situated between the lower end of the humerus and the upper ends of the two bones of the forearm. The only motions possible here are the bending and stretching of the forearm. The two bones of the forearm are connected above and below by means of pivot-joints, which enable inward and outward turning of the forearm and the hand. During outward rotation the radius and the ulna lie side by side, and the palm of the hand is directed forward; during inward rotation the radius is placed in front of the ulna, so that the two bones cross at an acute angle, and the back of the hand is directed forward. It should not be forgotten that in all these movements the radius always corresponds to the side of the thumb, and the ulna to the side of the little finger. The *wrist-joint* permits free motion of the hand forward, backward, inward and outward. The joints placed between the carpus and the metacarpal bones show only slight mobility; but the motion between the metacarpals and

the first phalanges is fairly free. The different phalanges of each finger are connected by means of true hinge-joints, which allow only flexion and extension.

5. **The joints of the lower extremities** likewise include several forms. Both hip-bones are connected in front through the *pubic symphysis* (see Fig. 44). This is a false joint consisting only of firm connective tissue which does not permit of any motion. True joints are found between the sacrum and each hip-bone, but the motion here is also very slight, since strong ligaments cover the joints behind. The bones of the pelvis thus form a very firm ring. One of the most important ligaments of the pelvis is *Poupart's ligament*, which runs from the upper anterior spine of the ilium to the spine of the pubis. It is placed exactly between the region of the abdomen and that of the thigh, and beneath it are placed the large blood-vessels for the lower extremities.

The hip-joint is a very freely movable joint, and its capsule is perhaps the strongest in the human body, although it has been known to tear in dislocations. The chief motions of the hip-joint are *flexion*, by which the thigh is raised against the abdomen; *extension*, whereby the thigh forms a straight line with the body; *abduction*, by which the thighs are separated from one another; *adduction*, whereby the thighs are brought together; and *rotation* inward and outward around the long axis of the thigh.

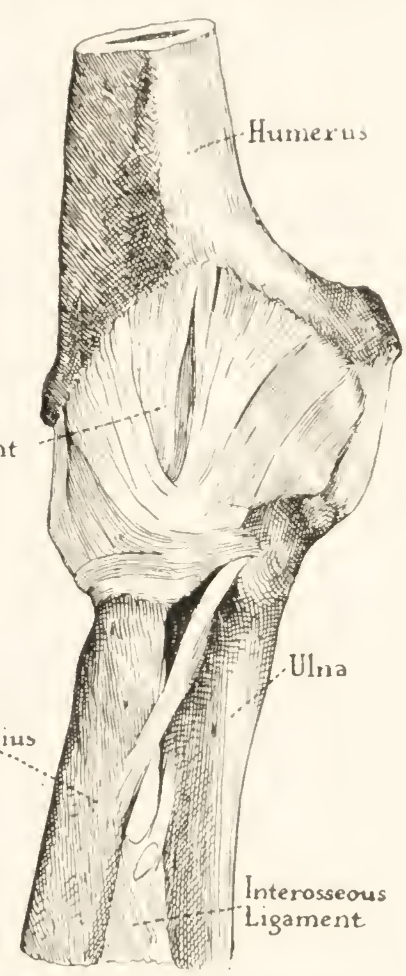


FIG. 42. Elbow-joint from in front.

Femur, tibia and fibula form the *knee-joint* (see Fig. 45), the capsule of which is also very dense, except above the patella. If fluid collects in the knee-joint, the bulging is naturally most pronounced in the upper part. The capsule is fortified by strong ligaments, as well as by the so-called *crucial ligaments*, which are placed in the interior of the joint, so that femur and tibia remain closely together, especially when the knee is bent. The head of the fibula is kept in close contact with the lateral tuberosity of the tibia by means of a small, slightly movable joint, the superior *tibio-fibular joint*. The lower ends of tibia and fibula, together with the astragalus, form the *ankle-joint*, the condyles of the two former grasping the latter like a fork. The joints placed between the astragalus and the calcaneum, and between these and the anterior bones of the metatarsus, enable elevation and depression of the two borders of the foot; that is, in and outward motion of the tip of the foot. The other joints of the foot have the same functions as the corresponding joints of the hand.

VIII.—THE MUSCLES

The skeleton of the human body is surrounded by muscles, which enable voluntary motion. Each muscle consists of a larger or smaller number of parallel fibres, known as the *muscle-fibres*. These fibres form *muscle-bundles*, separated by many strands of connective tissue fibres. The striation seen with the unaided eye, if a muscle is cut longitudinally, is due to these muscle-bundles, but on cross-section they give the muscle a more mosaic-like appearance. In order to see the separate muscle-fibres the aid of a microscope is necessary. At both ends muscles terminate in tendon-fibres, which are usually attached to some bone (see Fig. 16).

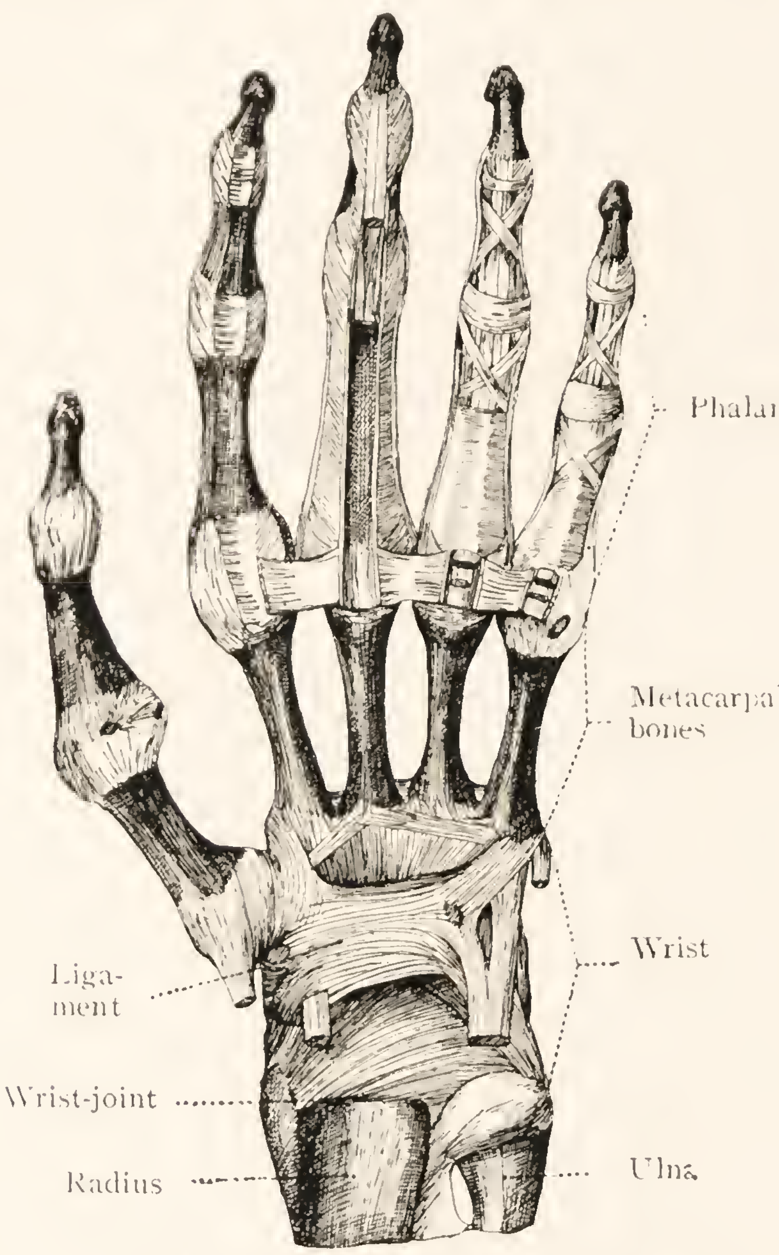


FIG. 43. Ligaments of the wrist and hand.

The form of muscles varies considerably in different parts of the body. In the extremities they are generally spindle-shaped; that is, the ends of the muscles are pointed and pass over into elongated tendons. The muscles of the trunk are generally more flat, and cover considerable surface; and their tendons (the abdominal muscles are examples) have a more membranous structure. Besides these, there are many other forms. Some muscles are fan-shaped (see "pectoralis major"; Plate I.), all the fibres converging toward one side; others possess two or more parts which finally end in a common tendon.

Every striped muscle possesses the property of contracting under the influence of the will; and as a result of such contraction it becomes shorter and thicker, while the bones to which it is attached approach each other (see Figs. 17 and 18). This mechanism explains all the motions of which the human body is capable. Even a layman can observe the contraction of a muscle, since it becomes distinctly hard to the touch. If, for example, the right hand is placed upon the upper part of the left arm and the latter then brought into extreme flexion, the muscles of the anterior surface will be felt to assume the form of a hard ball. The contraction of the *gastrocnemius* can be observed by lowering the tip of the foot.

The functional capacity of a muscle depends chiefly upon its thickness; and a voluminous muscle is therefore stronger than a thin one. The structure of a muscle, however, also plays an important part. If a muscle remains inactive for a long period of time, the muscle-fibres frequently undergo fatty degeneration, and may eventually disintegrate entirely; on the other hand, a muscle which is frequently called upon to contract may be able to do more than the usual amount of work. Fat-cells may accumulate also between the muscle-fibres, leading to a condition known as muscular atrophy. The muscles of a fractured arm, which is held tight in a plaster of Paris dressing, remain inactive for so long a time that they become atrophied; and when the dressing is eventually removed the circumference of the arm may be reduced by as much as one-half. From this it follows that daily active exercise is necessary for the preservation of strong muscles. It must be borne in mind, however, that a fatigued muscle should always be allowed sufficient time to recuperate, before systematic exercise is resorted to. If this is not done the size and functional power of the muscle may be lessened instead of increased. This is called overtraining a muscle. Most athletes are agreed that the best development is obtained by the frequent repetition of gentle exercise. For this reason dumb-bells weighing only a few pounds are generally used in the beginning, heavier weights being gradually selected. Excessive muscular exertion may react upon the entire system and give rise to muscular pains, sleeplessness, nervous disturbances of all kinds, temporary weakness of the heart, and albumin in the urine. All these symptons are frequently observed in mountain climbers; and they may be caused also by excessive bicycle riding. The food, also, has a marked influence upon the development of the muscles. Alcoholic beverages are particularly injurious, because a prolonged period of fatigue follows the temporary stimulation. Contraction of striated muscles may be brought about also by mechanical stimulation.

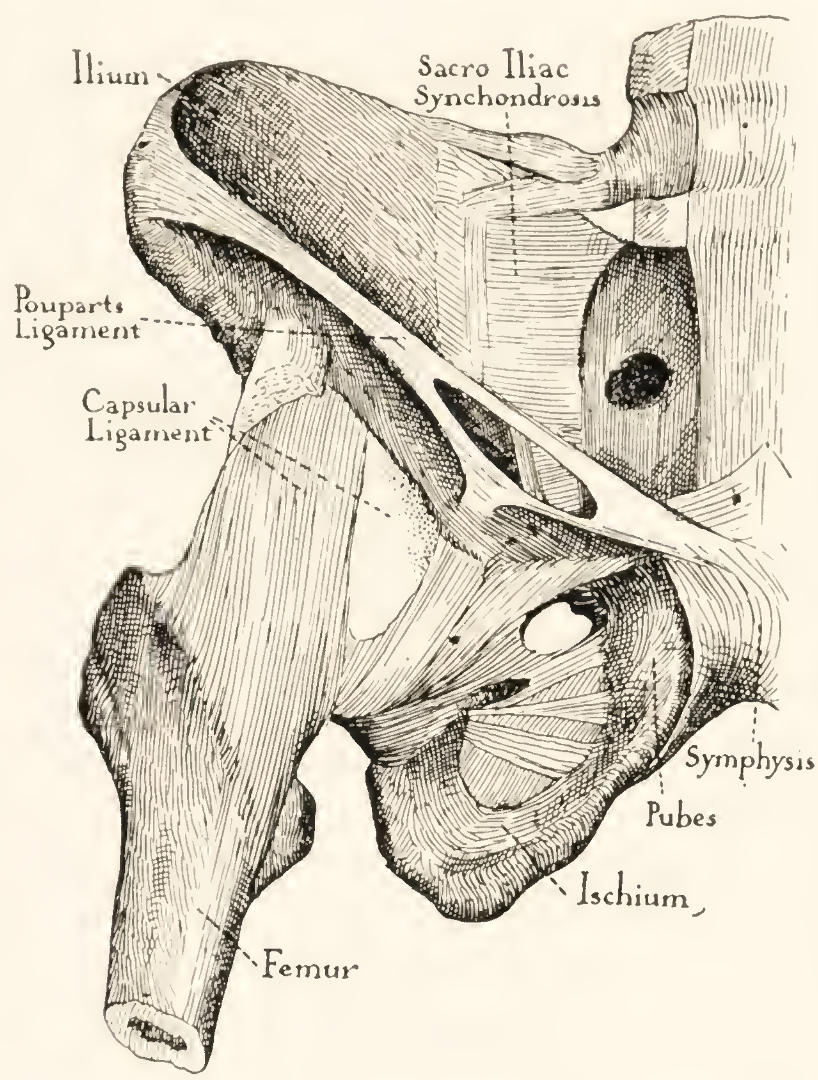


FIG. 44. The joints and ligaments of the pelvis.

The following is a brief description of the most important muscles and muscle groups of the human body (see Plates I. and II.):

1. **The muscles of the head** include the facial muscles, which bring about the various expressions accompanying emotions, such as smiling, crying, etc. The most important muscles of mastication are the *temporal* muscle (Plate II. 1) and the *masseter* muscle (Plate VII. 1) whose contractions close the jaw firmly. A number of muscles in the orbits turn the eye-balls in various directions.

2. **The muscles of the back** comprise a number of very strong muscles, of which the more superficial ones (*trapezius* and *latissimus dorsi*) move the shoulder-girdle and the arm. The contraction of the *trapezius* (Plates I. 2 and II. 4) results in the backward movement of the shoulder; its uppermost fibres, which originate at the back of the head, serve to raise the shoulders, and also act when weights are carried upon the shoulders or in the hands. This part of the muscle is strongly developed in hod-carriers. The *latissimus dorsi* (Plate II. 5) directs the downward movement of the upper arm, as when a descending blow is struck. The *erector spinæ* are placed deeply on both sides of the vertebral column, and serve to keep the spine erect. If the muscle of only one side contracts, the spine will be bent toward that side. The superior development of the erector spinæ of one side may give rise to spinal curvature.

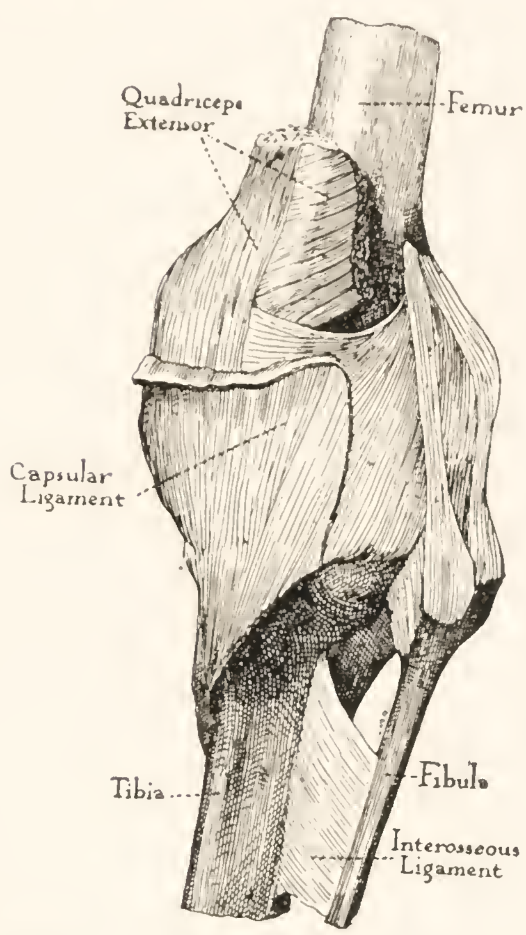


FIG. 45. The knee-joint seen from the side.

3. **The most superficial muscle of the neck** is the *platysma myoides* (Plate I. 14) which is located directly under the skin, covering all the other muscles. It gives mobility to the skin of the neck, but it requires a certain amount of practice to operate this muscle. If the platysma be removed, the strongest muscles of the neck, the *sternoclidomastoids* (Plates I. 1 and II. 3), will come to view. The left muscle rotates the head toward the right and bends it toward the left side; the muscle of the right side directs the opposite movements. Both muscles together keep the head in place, but have nothing to do with the movements of nodding. A number of smaller muscles placed between both sternoclidomastoids and the lower jaw serve to open the latter, and to move the larynx up and down during singing and talking.

4. **Among the muscles of the chest** the most important is the *pectoralis major* (Plate I. 3) which moves the arms forward and inward, as in the act of hugging, or folding the arms. The *intercostal muscles* are seated more deeply between the ribs and assist respiration. The *diaphragm* (Plate V. 8 and 26) is a membranous muscle, shaped somewhat like a bell jar; it separates the chest from the belly cavities. During contraction it

PLATE II.—MUSCLES OF THE HUMAN BODY

(From the back)

1. Temporal muscle	13. Tendo Achillis
2. Masseter	14. Peroneus longus
3. Sternoclidomastoid	15. Peroneus brevis
4. Trapezius	16. Deltoid
5. Latissimus dorsi	17. Triceps
6. External oblique of abdomen	18. Extensors of arm
7. Gluteus medius	19. Flexors of arm
8. Gluteus maximus	20. Interrosseous muscles
9. Semitendinosus	21. Posterior muscles of thigh
10. Biceps of the thigh	22. Flexors of thigh
11. Semimembranosus	23. Flexors of leg
12. Gastrocnemius	24. Peronei

(For a description of the functions of the various muscles, see pp. 134-139. See also Index to the Manikin)

Plate II.

flattens, so that air is sucked into the lungs and an inspiration takes place. Simple expiration is brought about by relaxation of the muscle. The elasticity of the ribs and the upward movement of the diaphragm force the air out of the lungs. In forced breathing, other muscles render assistance by raising and lowering the ribs.

5. **The muscles of the abdomen** include only one which is visible upon the surface; namely, the *obliquus externus* (Plates I. 8 and II. 6). This muscle, however, covers a number of other flat muscles in the front and lateral portions of the abdomen. The common action of all these muscles is to exert pressure upon the abdominal entrails, in order to discharge fæces and urine. With forced contraction, the abdominal muscles may also bend the trunk forward.

Directly above Poupart's ligament the abdominal muscles are perforated by an oblique canal, the *inguinal canal*, which is filled by the spermatic cord and vessels in man, and by the so-called round ligament and vessels in woman. Under abnormal conditions some loops of the intestines may force their way through this canal, resulting in an *inguinal hernia*, or rupture. If the intestines pass through beneath Poupart's ligament, the condition is spoken of as a *femoral hernia*. In both cases the intestines are, however, covered by skin (see RUPTURE).

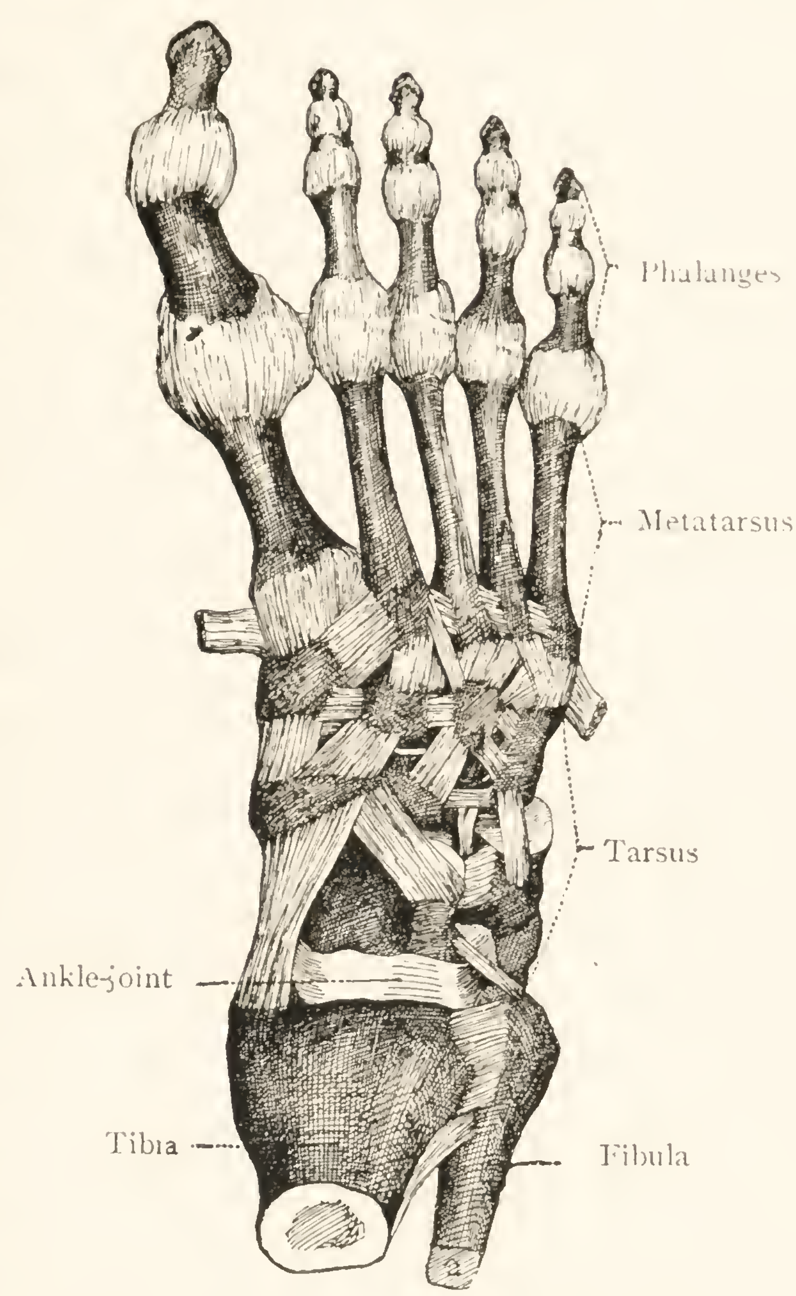


FIG. 40. The ligaments of the ankle and foot.

6. **The muscles of the upper extremities** are divided into muscles of (a) the shoulder, (b) the upper arm, (c) the forearm, and (d) the hand. The most important of the shoulder muscles is the *deltoid* (Plates I. 15 and II. 16), by the contraction of which the arm is raised. The muscles of the upper arm may be subdivided into *flexors* (Plate I. 16) situated on the front surface, and *extensors* (Plate II. 18), on the back surface of the arm. The most important flexor is the *biceps* (Plate I. 4); it can be readily felt as a globular swelling when the forearm is strongly bent, its chief function being to cause flexion at the elbow. Upon the posterior surface of the arm there is only one single muscle, the *triceps*, contraction of which

brings about straightening of the arm at the elbow (Plate II. 17). The muscles of the forearm also consist of flexors and extensors. The former (Plate I. 17) occupy the front and ulnar surfaces, and include muscles which bend the wrist and fingers forward, and rotate the forearm inward. They are concerned also in the grasping motions of the fingers. The extensors (Plates I. and II. 18) cover the back and radial surfaces, and enable straightening of the wrist and fingers, and outward rotation of the forearm.

The muscles of the hand are divided into three groups: (a) Muscles of the thumb (Plate I. 6); (b) muscles of the little finger (Plate I. 7); and (c) muscles of the middle portion of the hand. Chief among those of the last-named group are the *interosseous* muscles (Plate II. 20) which separate the fingers or bring them together sideways.

7. The muscles of the lower extremities include the following groups: (a) Muscles of the hip; (b) muscles of the thigh; (c) muscles of the leg; and (d) muscles of the foot. The muscles of the hip are again divided into an anterior and a posterior group. To the former belong the *psoas magnus* and the *iliacus*, which help to form the posterior wall of the abdomen (see Plate I. 19) and descend beneath Poupart's ligament to the trochanter minor. A very well-developed muscle of the posterior group is the *gluteus maximus* (Plate II. 8), contraction of which draws the thigh backward; together with other muscles it also raises the body from a bending position. Beneath this muscle are found the *gluteus medius* (Plate II. 7) and the *gluteus minimus* which draw the thigh outward, and a number of smaller muscles, the so-called *external rotators* of the thigh.

The thigh muscles form three large groups: (a) The extensors, (b) the flexors, and (c) the adductors. The *extensors* (Plate I. 21) occupy the anterior surface of the thigh; the most important of these are the *sartorius* (Plate I. 9), which enables one to cross the legs, and the *quadriceps extensor* (Plate I. 10), which extends the leg. The *flexors* (Plate II. 22), situated upon the back of the thigh, are called the *semitendinosus*, the *biceps*, and the *semimembranosus* (Plate II. 9, 10, 11). They serve to bend the leg; that is, draw it backward. The *adductors*, which are found upon the inner surface of the thigh, bring the legs together. The last-named group of muscles is generally well developed in riders.

The muscles of the leg also form three groups—viz. (a) The extensors, (b) the flexors, and (c) the two peronei. The *extensors* (Plate I. 22) occupy the front surface; among them the long extensor of the great toe (Plate I. 13) and the long extensor of the remaining toes (Plate I. 12) serve to extend the toes, while the *tibialis anticus* (Plate I. 11) raises the inner margin of the foot. The *flexors* (Plate II. 23) form the calf of the leg. The most prominent muscle of this group is the *gastrocnemius* (Plate II. 12) which lowers the tip of the foot, thereby raising the body on the toes. It terminates as a very well-developed tendon, known as the *tendo Achillis*

(Plate II. 13). Mountain guides and dancers, who use the tip of the foot rather than the entire sole, usually have a prominent calf, since the size of this part of the leg depends chiefly upon the gastrocnemius. The two long flexors of the toes are placed beneath the gastrocnemius, as is also the *tibialis posticus*, which turns the sole of the foot inward. The *peroneus longus* and the *peroneus brevis* (Plate II. 14, 15, 24) serve to elevate the outer border of the foot. They are important muscles in holding the ankle steady, as in skating.

The muscles of the foot, in analogy with those of the hand, are classified into muscles of the great toe, muscles of the little toe, and muscles of the median portion of the foot. Their functions are in the main the same as those of the corresponding muscles of the hand. On the upper surface of the foot there are, however, two additional short extensor muscles, one for the great toe and another for the remaining four (Plate I. 23) ; and on the lower surface, a short flexor for the four smaller toes.

IX.—INTERNAL ORGANS

The internal viscera comprise a number of organs which are placed chiefly in the interior of the body. Their functions are very varied : the organs of breathing and digestion take in certain substances which are necessary for the body ; the urinary organs hold certain excretory products ; and the sexual organs preside over the function of reproduction. The brain, spinal cord, and heart are by some not included among the viscera, since the two former really belong to the nervous system and the latter to the circulatory system.

Every system of viscera possesses cavities which communicate with the external air and which permit of a discharge of their contents. Each cavity is lined by a smooth, red, and slippery membrane, which is known as *mucous membrane*, because it secretes mucus under normal as well as under diseased conditions. For this purpose, many mucous glands are embedded in the mucous membrane. These glands are generally so small that they can be detected only under the microscope ; but occasionally they may attain the size of a pea. The red lining seen on looking into the mouth is mucous membrane.

1. The Organs of Respiration include (a) the nasal fossæ, (b) the pharynx, (c) the larynx, (d) the trachea, and (e) the two lungs.

The nasal fossæ (Fig. 47) begin at the two nostrils, and end at the considerably larger posterior nares which pass over into the uppermost part of the pharynx. The left nasal cavity is separated from the right by the *septum*, which is generally bent slightly to one side. The palate forms the floor of the nasal cavity, and at the same time separates the latter from

the mouth. Upon the lateral (outer) walls of the nasal cavities are found three elongated prominences, known as the *turbinated bones*, which are directed obliquely downward. The upper is the smallest, the lower the largest of the three. These prominences are supplied upon their surface with many blood-vessels, which rapidly heat the air as it passes through the nose. The mucus present in the interior of the nose serves to entangle

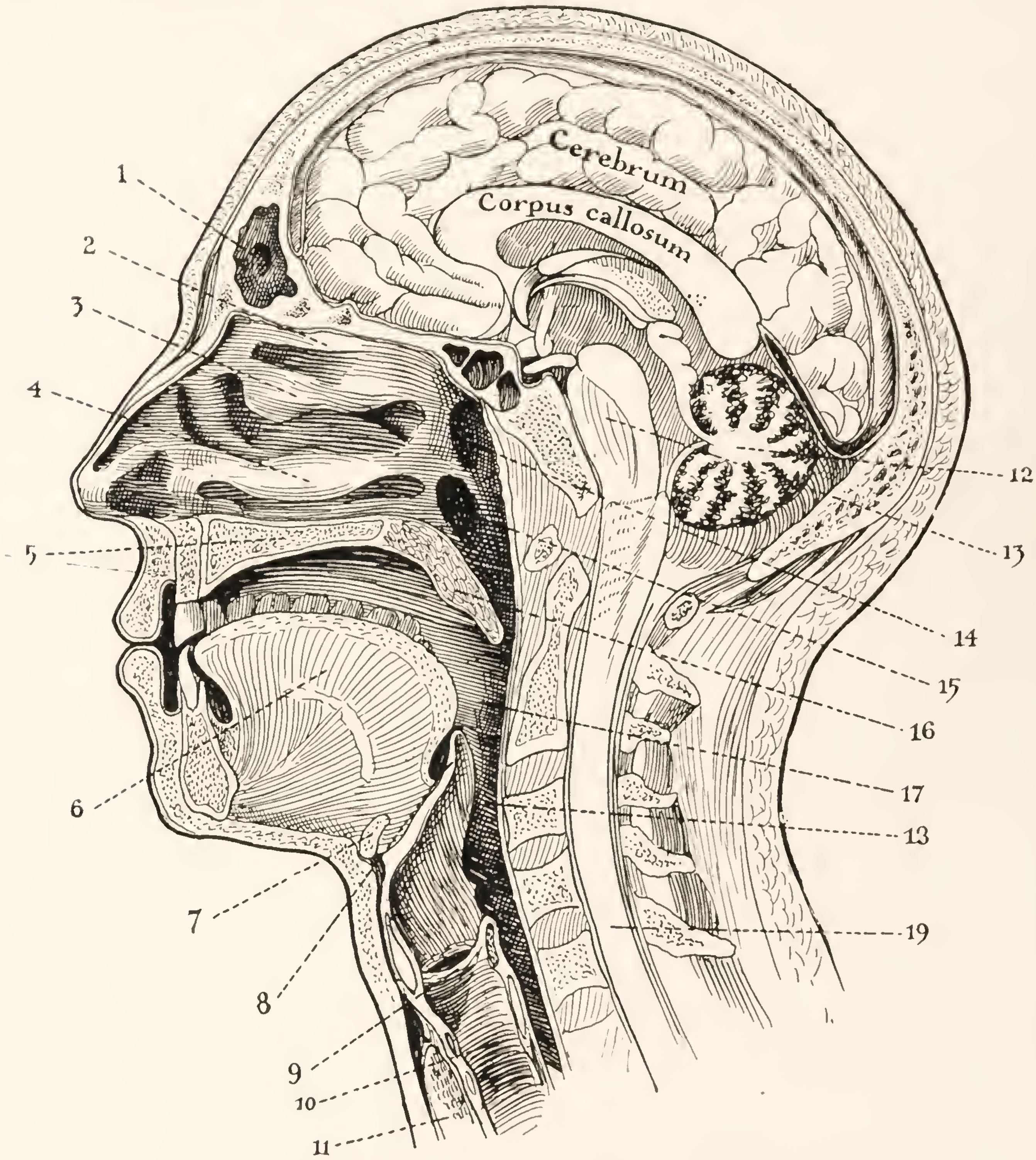


FIG. 47. Cross-section through the middle of the head and neck.
1, Frontal sinus; 2, 3, 4, upper, middle, and lower turbinated bones; 5, hard palate; 6, tongue; 7, hyoid bone; 8, epiglottis; 9, larynx; 10, trachea; 11, thyroid; 12, cerebellum; 13, medulla; 14, naso-pharynx; 15, Eustachian tube; 16, soft palate; 17, pharynx; 18, œsophagus; 19, spinal cord.

small particles of dust which are inhaled with the air, thus preventing them from reaching the deeper parts of the respiratory tract. This mucus is slowly carried forward by means of ciliated epithelial cells found in the back of the nose, so that admirable conditions are present for purifying the air which passes through. It is, therefore, always advisable to breathe through the nose and not through the mouth, because in the latter case cold air and various impurities may easily get into the lungs. The organ of smell is located in the upper half of the nasal cavity, where the terminal

branches of the olfactory nerve spread out in the mucous membrane and thus come into contact with the air.

The pharynx is the cavity situated behind the posterior nares, the mouth and the larynx; and it may thus be divided into three parts: (1) the *naso-pharynx*, placed behind the nasal cavity; (2) the *oro-pharynx*, behind the mouth; and (3) the *laryngo-pharynx*, behind the larynx. Only the upper and middle portions transmit air, the lower portions forming a passage for food as it is transmitted into the œsophagus. In the naso-pharynx is

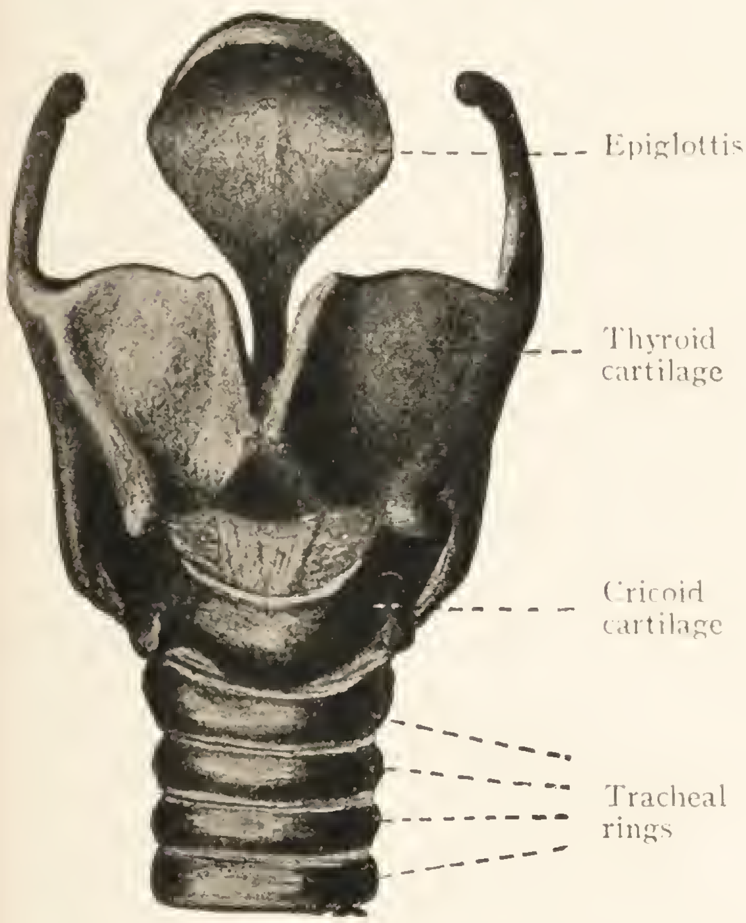


FIG. 48. The larynx seen from in front.

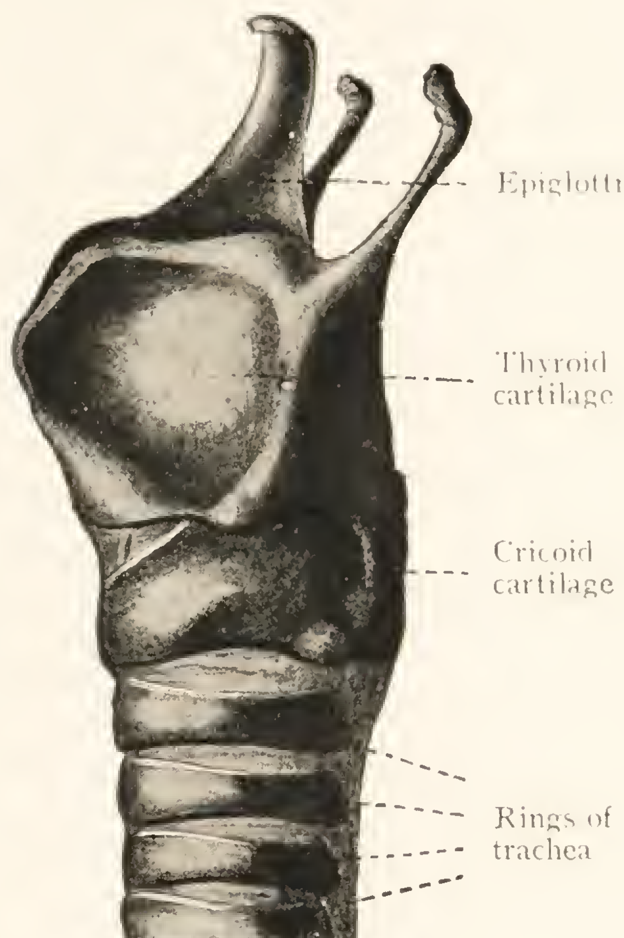


FIG. 49. The larynx seen from the side.

(The various cartilages are held together by ligamentous bands.)

located the opening of the *Eustachian tube*, a funnel-shaped canal which serves to connect the naso-pharynx with the middle ear or *tympanic cavity*. Through this canal inflammatory processes may easily spread from the nasal cavity or naso-pharynx to the middle ear and drum-membrane, and thus give rise to inflammation of the middle ear (see EAR, DISEASES OF).

The larynx is an organ consisting of cartilages, ligaments, and muscles. The largest cartilage (*thyroid cartilage*) can be easily felt by passing the finger along the middle line of the neck in front. In men this cartilage is especially prominent, and forms the so-called *Adam's apple*. Below the thyroid cartilage are the *cricoid cartilages*, and on the upper, posterior portion of the latter, the *arytenoid cartilages* (Figs. 48, 49, 50). The cartilages are connected by joints and ligaments, and may be moved upon each other by means of muscles. The most important ligaments are the *vocal cords*, a false and a true one being placed one above the other on each side. The space between the true vocal cords is known as the *glottis*.

A general idea of the shape of the vocal cords can be obtained from Fig. 51. In this illustration the larynx appears as if cut through on a plane parallel with the forehead, so that the front ends of the vocal cords are exposed to view. It is apparent that the interior of the larynx is considerably narrowed by the vocal cords projecting from the right and left side. When the true cords approach each other so closely that their edges come into contact, the larynx will be closed and expiration rendered impossible. The voice is produced by the impact of air on the periodically opened and closed true vocal cords. A certain amount of tension on the part of the vocal cords is necessary in order to produce sound, and this is brought about by the laryngeal muscles, which also dilate and contract the glottis. The larynx, however, has nothing to do with the production of speech, whispering being still possible if it is removed (see Part II., *s.v.* VOICE AND SPEECH).

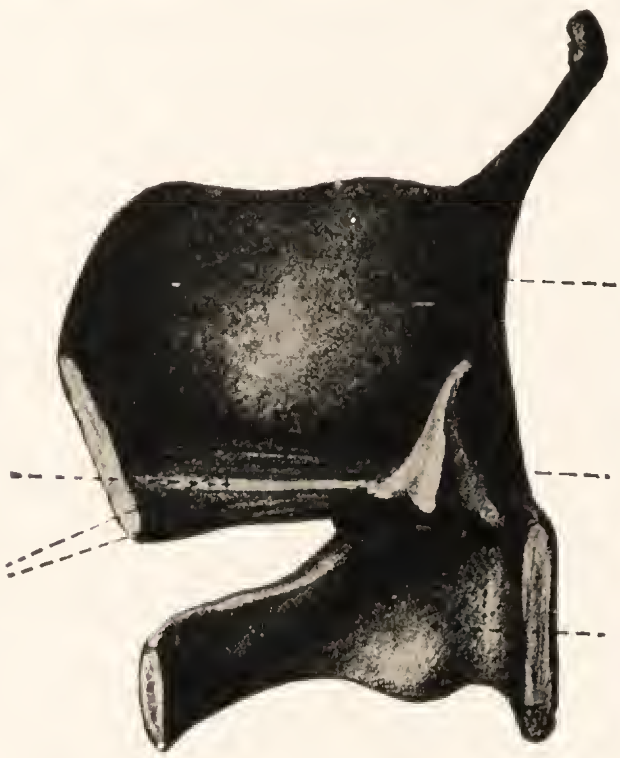


FIG. 50. Structure of interior of larynx from side.

The trachea is the direct continuation of the larynx. It is placed in the middle line of the neck, directly under the skin, and in front of the œsophagus. Entering the chest it finally divides at the level of the fourth dorsal vertebra into the two *bronchi*, of which the left enters the left lung and the right the right lung (Plate IV. 20, 23, and 6). The left bronchus again divides into two and the right into three branches, corresponding to the lobes of the lungs. Each branch breaks up into smaller ones like the branches of a tree, so that the diameter of the terminal bronchi does not exceed $\frac{1}{25}$ of an inch (see Fig. 52). Horseshoe-shaped pieces of cartilage (see Fig. 49) are placed in the walls of the trachea to keep it

FIG. 51. Structure of interior of larynx, seen from in front.

open, and the bronchi are supplied with similar irregular plates. The inner surfaces of the trachea and the bronchi are lined, like the larynx, with mucous membrane with ciliated epithelium.

The thyroid gland, a peculiar, horseshoe-shaped organ (Plate IV. 19), is placed in front of the uppermost portion of the trachea. Properly speaking, however, it cannot be classed among glands, since it does not possess an excretory duct after birth. The narrow middle portion is located directly in front of the trachea whereas the two thickened lateral portions lie by the sides of the larynx, their pointed ends projecting upward.

The functions of the thyroid gland are not well known. It is, however, supposed that certain substances necessary for the body are absorbed by the blood as it flows through this organ. At all events, it is certain that diseased conditions of the organ interfere seriously with health. A disease known as GOITRE, which consists in a morbid enlargement of the thyroid gland, is common in certain mountainous regions, and may cause very disagreeable symptoms. Enlargement of this organ also occurs in EXOPHTHALMIC GOITRE, a disease which is characterised by marked protusion of the eyeballs. For the morbid conditions resulting from atrophy of the thyroid gland, see THYROID GLAND, DISEASES OF.

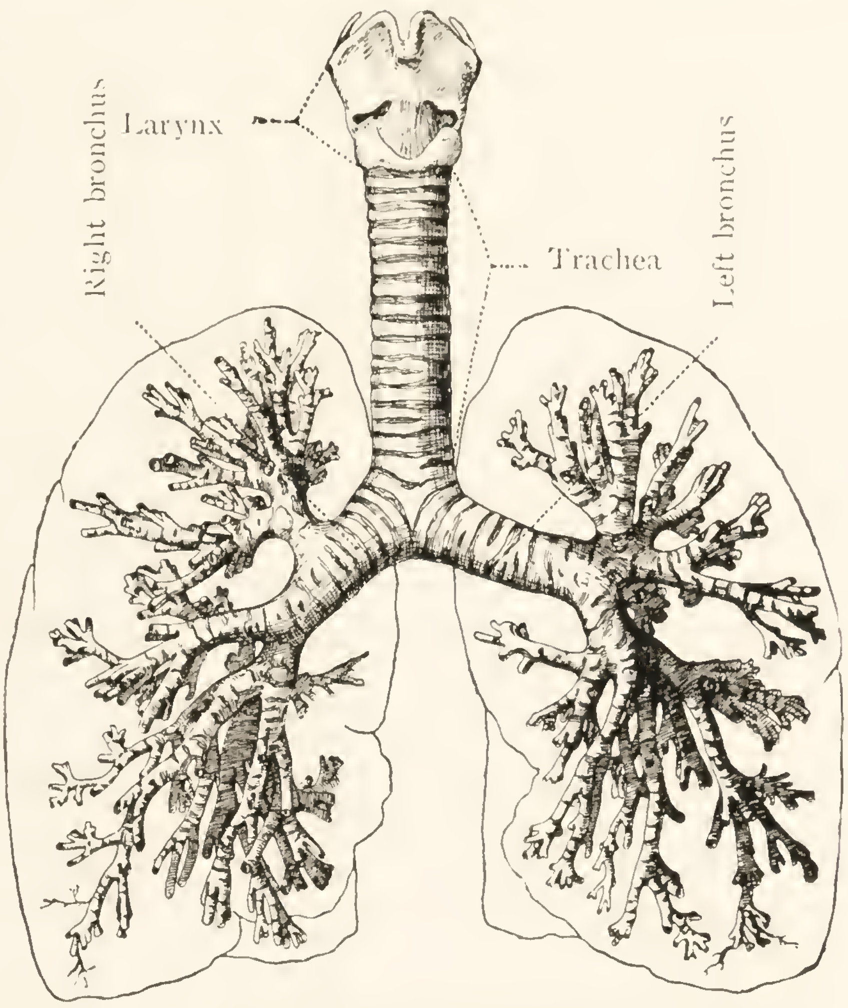


FIG. 52. The larynx, trachea, and bronchi, and their branches. Seen from the front.

The lungs are two spongy, air-filled organs which occupy the greater part of the thorax (Plate III. 3 and 12). Almost the entire process of respiration goes on within them. Their flattened and somewhat hollowed base rests upon the diaphragm; the apex projects from 1 to 1½ inches above the clavicle and first rib; the inner, or mesial, surface adjoins the heart; and the lateral, or outer, surface the thoracic wall. The bronchi, and the pulmonary arteries and veins form a thick strand, known as the root of the lung, which enters the lung upon its mesial surface. The colour of the lungs is yellowish-white in animals and newly-born infants, while in adults it is slate-tinted or, in places; even black, owing to the deposit of small particles of coal which are constantly present in the air of smoky or dusty towns. The shade of red (pink to dark red) depends upon the amount of blood present.

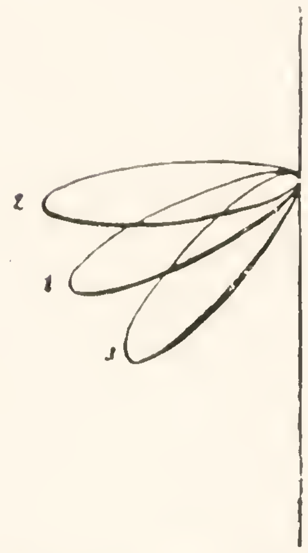


Fig. 53. Rise and fall of the ribs during breathing.

The finer structure of the lungs is as follows: Every terminal bronchus ends in a small air-sac, which has numerous excavations upon its surface and is adherent to the neighbouring sac. The walls of the sac are abundantly supplied with elastic fibres, which give the lung its pronounced elasticity. When taken out of the body a lung will contract and force out all its air, but it may again be distended by blowing air through the bronchus. The lungs would contract also within the body, were it not for the fact that they are closely applied to the unyielding walls of the chest.

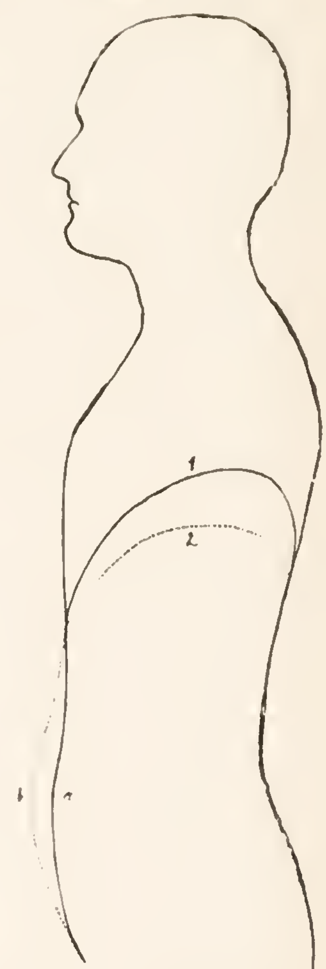


Fig. 54. Movement of the diaphragm and abdominal wall during breathing.

The walls of the air-sacs also contain a very fine network of blood-vessels, whose exceedingly thin walls lie so near the surface that they almost come into contact with the air of respiration. In these vessels an exchange of gases takes place between the air and the blood. The red blood-corpuscles attract the oxygen of the inhaled air, while the blood gives off carbonic acid and water vapour to the expired air. In cold weather the presence of these vapours renders the expired air visible. The elevation of the chest with inspiration, and the depression with expiration, can be readily felt by placing the hands flat upon the chest while breathing deeply. If the vertebral column be looked upon as a perpendicular line, and the ribs as a ring articulating with this line (see Fig. 53), the position of rest is shown at 1. If the ring be raised to position 2, an inspiration will follow; if again lowered to 1, an expiration will result. From this it follows that a contraction of the muscles connected with the chest is required only during inhalation. With forced expiration, however, the ring is lowered still further to the position indicated by 3. This form of respiration is known as *thoracic* or *costal* breathing.

Fig. 55. The female type of breathing.

In addition to the ribs, the diaphragm and abdominal muscles are also active during breathing; and it can be readily observed that the former

muscle imparts its movements to the abdominal walls (see Fig. 54). The position indicated at 1 shows the diaphragm at rest; as it contracts it becomes flattened (assuming position 2), thereby sucking air into the chest (inspiration). At the same time it presses somewhat upon the abdominal organs, so that the abdominal walls move forward (from position a to b). This in turn causes the abdominal muscles to contract, thus exerting a pressure upon the abdominal organs, which again force the diaphragm upward. This type of breathing is called *diaphragmatic*, or *abdominal*, and is the usual form of respiration in the male sex, because the excursions of the abdominal wall are greater than those of the thorax. In the female sex, however, the thoracic type is prevailing, since the ribs participate more in breathing; hence the phrase "heaving of the bosom" (see Fig. 55, where the shaded portion indicates the change in shape with inhalation).

The outer surface of the lung is covered by a smooth, glistening membrane, the *pleura*, which adheres so firmly to the lung that it cannot be stripped off. This part of the pleura is called the *inner* layer. The pleura covers also the root of the lung and is then reflected upon the inner surface of the thoracic wall, where (under the name of *costal* or *outer* layer) it clothes the upper surface of the diaphragm and the lateral surface of the heart (Plate III. 4 and 13), being firmly adherent also to these parts. A small amount of lymphatic fluid, contained between the inner and outer layers of the pleura, acts as a lubricant. In pleurisy, "water in the chest," etc., the amount of fluid between the two layers may be greatly increased. The lung will then be pushed away from the wall of the chest, and is often so much compressed that breathing becomes very difficult. See PLEURISY.

2. The Organs of Digestion comprise the following: (a) The mouth and the salivary glands; (b) the pharynx; (c) the œsophagus; (d) the stomach; and (e) the intestines, with liver and pancreas. The spleen is frequently classed with the digestive organs, although it has nothing to do with digestion. It is known to elaborate certain constituents of the blood.

The mouth may be divided into three parts: the vestibule of the mouth; the mouth proper; and the back of the mouth.

The *vestibule* constitutes the narrow space between the lips and cheeks on one side and the front surface of the teeth on the other. The entrance is formed by the lips, and is known as the *oral orifice*. Part of each tooth is contained in the bony substance of the upper or lower jaw; a part is covered by the gums; and a third part projects free into the mouth. The first portion is the *root*; the second, slightly constricted, portion, the *neck*; and the third, exposed, portion, the *crown* of the tooth. The crown is covered on its upper surface by an exceedingly hard substance, the *enamel*. The interior of each tooth contains the dental cavity, filled with a pale red, soft substance (the *pulp*) which is composed of the nerves and blood-vessels of the tooth. The *periosteum* of the tooth forms a thin membrane

on the surface of the root ; in bad teeth it frequently becomes inflamed, and gives rise to severe pain.

The normal number of teeth for adults is thirty-two ; that is, eight for each half of each jaw. Beginning from in front, there are on each side two *incisors*, one *canine*, two *bicuspids* and three *molars*. During childhood the incisors have three distinct prongs, but as these are used up they become chisel-shaped. They are used for seizing and biting off morsels of food. The canines are prominent, awl-shaped teeth. In beasts of prey they form hooks, so that the prey can be more readily held. The bicuspids have two prongs upon their chewing surface ; the molars four to five. The chief function of these teeth is to crush and grind the food.

With rare exceptions every human being is born without teeth. Between the six or seventh month and the beginning of the third year, the temporary teeth, or milk teeth, make their appearance. They are called *temporary* because they fall out later, and are replaced by the permanent set. The temporary set consists of incisors, canines, and two premolars, with four or five projections upon the free surface. Each half of the upper and lower jaw has, therefore, five teeth instead of eight. The temporary teeth are replaced by the permanent between the sixth and twelfth years. The three most posterior molars of each side, however, appear only once ; the first between the fifth and sixth, the second between the twelfth and fourteenth, and the third between the twentieth and fortieth years. It follows that the first molars are the oldest of the teeth of adults, and hence wear off before the others. The third molars are frequently called " wisdom teeth " ; their eruption is often very painful, because the gums have usually attained considerable firmness at the time of their appearance.

The mouth proper contains upon its floor the tongue, which is chiefly made up of striated muscle-fibres. These are covered by a mucous membrane, containing many small projections (*papillæ*) in which the nerves of taste terminate. The lower surface of the tongue is connected with the floor of the mouth in the median line by a fold of mucous membrane, known as the *frænum*. The tongue is the chief organ of speech ; yet it is a mistake to believe that children will acquire speech more readily if the frænum be cut or loosened. See TONGUE-TIE. The roof of the mouth is formed by the palate, the anterior, bony portion of which is called the *hard palate* and the posterior, movable portion, the *soft palate*. If the soft palate is raised, as in swallowing, the uppermost portion of the pharynx and the nasal cavity may be completely closed. The posterior edge of the soft palate shows an elongation, the *uvula*, which is of no special importance.

The excretory ducts of three salivary glands empty into the mouth proper on each side. These glands produce the *saliva*, the functions of which are to lubricate the mouth, to bring into solution the starchy ingredients of food by converting them into sugar, and to thoroughly moisten the food.

The largest salivary gland is the *parotid* (Plate X. 1), a flat, triangular organ which is placed directly in front of the ear and beneath the zygomatic arch. Its excretory duct, which is the size of a goose-quill, empties into the mouth opposite the last molar tooth. Inflammation of this gland by a special infection leads to MUMPS (which see). The *submaxillary gland* (Plate X. 2) is about half as large as a walnut and is placed mesial to the angle of the lower jaw. The *sublingual glands* lie upon the floor of the mouth on both sides of the frænum of the tongue, where the excretory ducts of the submaxillary glands may also be found.

The back of the mouth is a triangular space, the apex of which corresponds to the posterior edge of the soft palate (see Fig. 56). The base lies next to the base of the tongue, and the anterior and posterior limits are formed by two folds of mucous membrane, known respectively as the anterior and posterior *palatine arch*. Between these two arches may be seen an almond-shaped elevation, the *tonsil*. The tonsils may be regarded as lymph-nodes into which the lymph-channels of the pharynx and mouth drain. They may enlarge to the size of walnuts, and may even touch one another, thereby closing the entrance into the pharynx. In such cases it becomes necessary to remove the enlarged organs by an operation.

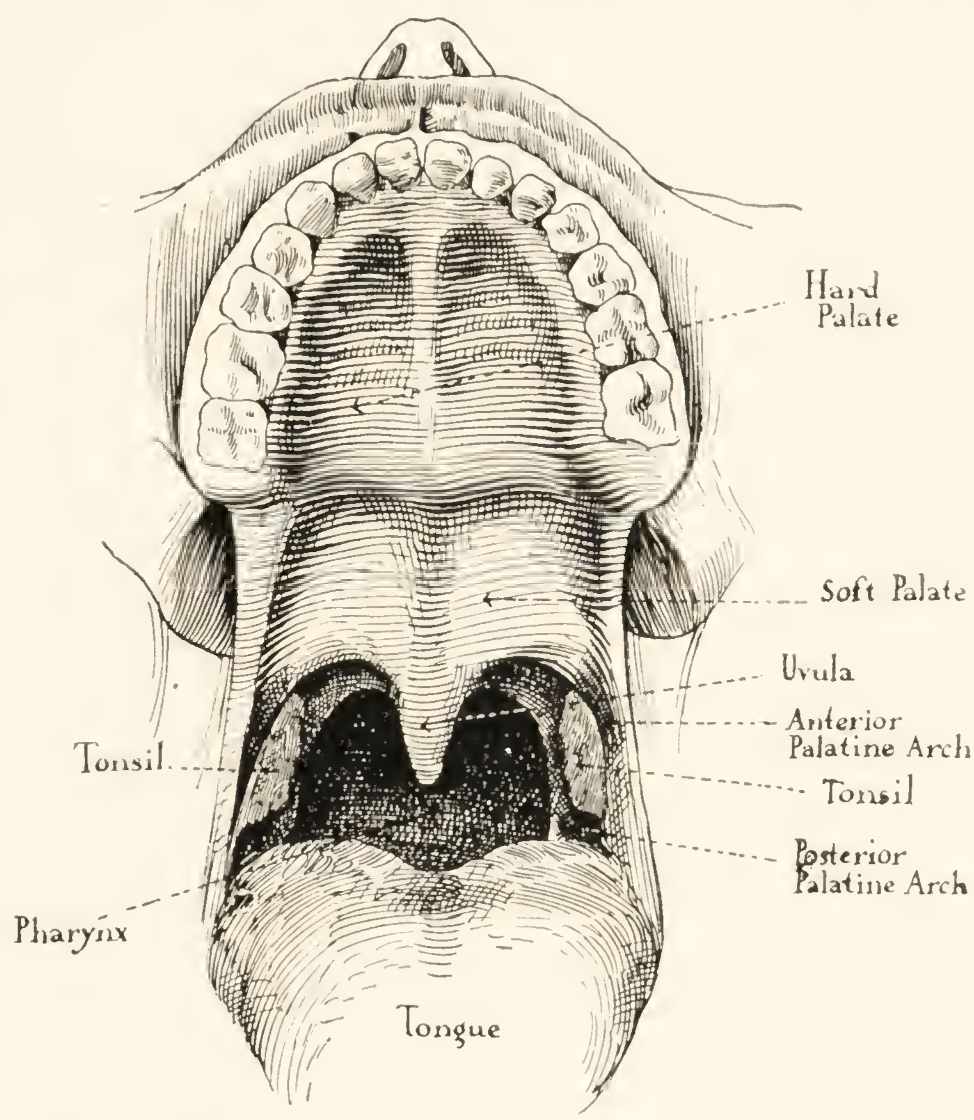


FIG. 56. View of mouth and pharynx, the jaws being wide open.

The pharynx has already been described as an organ of respiration in the preceding chapter. Only the middle portion, behind the mouth, and the lower portion, behind the larynx, act as a passage for food. The food is propelled downward by means of flat, striated muscle-fibres which lie in the walls of the pharynx, and which are known collectively as the *constrictors* of the pharynx. The inner surface of the pharynx is abundantly supplied with mucous glands, which produce the large amount of mucus generally troubling smokers and drinkers in the morning, and which makes it necessary for such people to frequently clear the throat by hawking and coughing.

The œsophagus, or *gullet,* is a continuation of the pharynx (see Plate IV. 7), and consists of a cylindrical tube which enters the thorax behind the trachea and in front of the vertebral column, finally penetrating the diaphragm to become continuous with the stomach. The wall of the œsophagus contains many muscle-fibres, but these are smooth, and not under the influence of the will. For this reason the food, after being swallowed, is involuntarily forced down into the stomach.

The stomach (Plates IV. 27, and III. 15) is an approximately pear-shaped organ. On the left side, directly under the diaphragm, it communicates with the œsophagus by means of the cardiac orifice ; and on the right side it is continued into the intestines by means of a ring-shaped constriction, the *pylorus.* The large dilated portion directed upward and to the left, toward the diaphragm, is known as the *fundus.* The largest part of the stomach is placed in the left side of the body, and only one-sixth extends beyond the middle line to the right. Another small portion is in contact with the anterior abdominal wall, directly under the liver in the epigastric fossa. The size of the stomach depends largely upon the amount of fluid it contains, and also upon the degree of contraction or relaxation of the smooth muscle-fibres present in its walls. Besides this, the size varies considerably in different people. Even a healthy stomach may extend as far as the navel if distended. If it reaches still lower down, it is spoken of as a morbid dilatation of the stomach. See Stomach, Dilatation of.

The stomach serves to store up the undigested food temporarily, to thoroughly mix the food, to begin the digestion of albuminous foods (meats, etc.), and to loosen up the fats from their connective tissue envelopments. These functions are possible by reason of the gastric juice, which is secreted by many glands placed in the mucous membrane of the organ.

The gastric juice is a pale fluid containing $\frac{1}{5}$ per cent. hydrochloric acid mixed with a peculiar chemical substance (a ferment) called *pepsin.* The digestion of food depends chiefly upon the presence of a sufficient amount of this gastric juice. The digestibility of various articles of food varies, however, within wide limits. See Foodstuffs. Thus fat meat is more difficult to digest than lean, because it takes longer for the watery gastric juice to penetrate the former than the latter. It is of the utmost importance thoroughly to chew all food taken in, as this will insure thorough moistening with saliva and permit the gastric juice to penetrate better. Palatable foods cause all digestive fluids to be secreted more abundantly, and the entire process of digestion to be more rapidly completed. For this reason children should never be forced to eat food for which they have a distaste. During sleep, and after severe bodily exertion, digestion proceeds very slowly, and the stomach should, therefore, not be overfilled at such times.

The intestinal tract is a tube six to seven yards long, which is attached to the pylorus. Its chief functions are to complete digestion and to absorb

food which has been dissolved and chemically altered by the digestive fluids, and which is then carried into the circulation of the body by way of the lymphatics. The length of the intestines varies in man and in the different animals. Grass-eating animals, who digest slowly, usually have a very long gut and take in large amounts of food; while meat-eating animals are generally satisfied with one meal a day, their intestines being considerably shorter. The actual length of the intestinal tract in man is, however, considerable; and as it lies in the abdomen, the gut forms a number of curves known as the *intestinal loops*.

The intestinal tract is divided into the small and the large intestine. The former digests and absorbs, while the latter stores up the undigested fæcal matter preparatory to its discharge from the body.

The small intestine (Plate III. 18) is divided into three parts: the duodenum, the jejunum, and the ileum. Of these the *duodenum* (from Latin *duodeni*, "twelve each," its length being about equal to twelve finger-breadths) is the shortest; it is approximately horseshoe-shaped, and its hollowed side to the left contains the head of the pancreas. The *jejunum* (from Latin *jejunus*, "hungry") is generally empty after death. It passes insensibly into the *ileum*, which forms many loops in the abdominal cavity, finally joining the large intestine in the right iliac region (Plate IV. 16). At the point of juncture there is a two-lipped valve (valve of Bauhini), which is so arranged that the contents of the large intestine cannot pass back into the small. The current of fæces, therefore, is always in the direction from the small to the large intestine. Both jejunum and ileum are fastened to the posterior abdominal wall by means of a membranous structure known as the *mesentery*.

The large intestine is also divided into three portions: the cæcum, the colon and the rectum. As a whole, the large intestine forms an incomplete quadrangle (Plate III. 8, 16, 17) which surrounds the loops of the small intestine like a frame. The *cæcum* (Plate IV. 15) forms the shortest part of the large intestine; it constitutes a short pouch-like structure in the lower right portion of the abdomen near the right iliac fossa, and the small intestine empties into it. It is characterised also by the presence of a worm-shaped appendage, known as the *vermiform appendix* (Plate IV. 17). This appendix is not only unnecessary for man, but often actually dangerous, since it may form the starting-point for a fatal peritonitis. See Appendicitis; Peritonitis. The cæcum passes insensibly into the colon, the largest portion of the large intestine. The *colon* first ascends on the right side (ascending colon; see Plates IV. 13 and III. 8); it then crosses at right angles to the left side (transverse colon; Plates III. 16 and IV. 11, 29), along which it descends at another right angle (descending colon; Plates III. 17 and IV. 31), finally forming an S-shaped loop (*sigmoid flexure*; Plate IV. 32) which joins the rectum. The *rectum* is the termination of the large intestine, which lies in the true pelvis (Plate IV. 33).

The liver (Plates III. 6, 14; IV. 9) is the largest gland of the human body and chiefly occupies the space beneath the diaphragm. On the left side it touches the stomach. Its chief function is to elaborate the bile, which modifies the fats of the food so that they can be absorbed by the intestines. As the bile is secreted it collects within the liver in a number of fine ducts, the *biliary ducts*, which lead into a larger one, the *hepatic duct*, placed at the lower surface of the liver. This duct is connected with a pear-shaped organ, the *gall-bladder* (Plate III. 7), the excretory duct of which joins that of the liver to form the common *bile-duct* (Plate IV. 10) which finally empties the bile into the middle portion of the duodenum.

The pancreas (Plate IV. 28) is a gland of considerable size, the most intimately known function of which is the production of pancreatic juice. It is of elongated, triangular form, and is placed along the posterior abdominal wall, behind the transverse colon and the stomach. The left, narrow end touches the spleen; the right, thicker end fills out the concavity formed by the duodenum. The excretory duct of the pancreas lies in the long axis of the organ, and empties into the duodenum at the same place where the bile-duct penetrates the gut. The pancreatic juice has a complex action upon food, since it contains at least three digestive ferments, which convert starches into sugar, digest the proteid foods (albumin, connective tissue, gelatine, etc.), and also render fats more digestible.

The spleen (Plate IV. 26) may be described with the digestive organs, although it is only placed in immediate proximity to these, without participating in the actual process of digestion. It has the size of a small fist and the shape of a coffee bean; and it is situated to the left of the spinal column, between the stomach and the diaphragm. In diseases (as in malaria or typhoid) the spleen may enlarge considerably, and may even be felt beneath the ribs in the left side. After excessive exercise the organ may become overfilled with blood and give rise to disagreeable stitches in the side. The functions of the spleen are not thoroughly understood. It elaborates certain elements of the blood, besides having other less well-known functions.

The inner surface of the abdominal walls is covered by the outer layer of the *peritoneum*. At the posterior abdominal wall, this layer is reflected as a more or less complete cover of most abdominal organs. The mesentery, already mentioned, is a continuation of the peritoneum, and connects the outer layer of the latter with the intestines. The great *omentum* (not shown on Plate III.), which hangs down from the transverse colon and covers the small intestine, is merely an apron-like prolongation of the mesentery. The peritoneum is a thin, smooth membrane which imparts to the intestines their normal, glossy appearance.

3. The Urinary Organs include: (a) the two kidneys, (b) the two ureters, (c) the bladder and (d) the urethra.

The kidneys (Plate V. 11, 30) are bean-shaped organs lying along the posterior abdominal wall on both sides of the lumbar vertebræ. Each kidney is so placed that its indented mesial edge points toward the spine. This edge forms a fissure-like depression (the *hilum*) where the large blood-vessels enter and the ureter leaves the organ (Plate V. 10, 13, 29, 37). Both kidneys are held in place by a deposit of fat, which is known as the fatty capsule of the kidney. The finer structure of the kidney resembles that of a gland. It is made up of a number of much contorted and twisted tubes, the *uriniferous tubules*, which all empty into the ureter at the hilum. The chief function of the kidney is to make the urine. This fluid is derived in part by filtration from the blood which flows through the kidneys; but it also contains substances secreted by the epithelial cells which line the uriniferous tubules. The chief substances derived from the blood are water and various salts, while those secreted by the epithelial cells are urea, uric acid, and other principles which are removed from the blood. The colour of urine depends chiefly upon the amount of water it contains; if a large quantity of water is present, it appears pale; while with less water and more salts, it becomes darker. See URINE. The colour as well as the amount of the excreted urine stands in close relation to the amount of fluid ingested and to the quantity of water lost by perspiration. If one drinks much, the urine will be abundant and pale in colour; if perspiration is active, the colour will be darker and the amount less.

The two ureters (Plate V. 13, 37) convey urine from the kidneys to the bladder. They originate at the hilum of the kidneys, in a dilatation known as the *renal pelvis*, and then pass downward along both sides of the spine, emptying into the deepest part (or *floor*) of the bladder. When distended, their thickness is about that of a penholder.

The bladder (Plates III. 9; IV. 34; V. 18) is an egg-shaped organ. When completely filled with urine, it may reach as high as the navel; but when it empties it occupies only the space behind the pubic symphysis. In keeping with the more roomy pelvis, the bladder is larger and broader in the female sex than in the male. The bladder may be regarded as a receptacle which stores up the urine secreted by the kidneys and carried down to it by the ureters. The urine is prevented from flowing out of the bladder by a ring of smooth muscle tissue (*sphincter*) which is usually tightly contracted. Many muscle-fibres are placed also within the walls of the bladder, and by their contraction these aid in forcing out the urine. As soon as the bladder becomes distended by the pressure of urine, the muscle-fibres in its walls contract and start the impulse to urinate; this impulse, reinforced by the will, causes the sphincter to relax, thereby permitting the urine to flow out of the bladder through the urethra. In the female the urethra is only about an inch long; in man, however, it attains a length of from eight to ten inches.

X.—THE CIRCULATORY SYSTEM

The chief organs of the vascular system are the blood and lymph vessels, containing respectively blood and lymph. The lymph is a clear fluid which may be described as blood without the red blood-corpuscles. The nourishment of the body depends chiefly upon this lymph, since it saturates all tissues and surrounds all cells so that these can absorb the necessary nutritive material from it. The lymph of the tissues is first collected in exceedingly thin, delicate tubes, the fine lymph-channels, which gradually unite to form larger vessels. The two chief trunks empty into the circulatory system by way of the subclavian veins. Since the lymph-vessels absorb the lymph and carry it into the blood, they have also been called absorbent vessels.

The blood-vessels, on the other hand, form a completely closed system of tubes, filled with blood. The fluid constituents of the blood pass through the walls of the blood-vessels, and thus form the lymph. Some of the white corpuscles also penetrate the walls; but under normal conditions the red cells escape only when there is a tear in the walls of the vessels. The vessels which carry the blood from the heart to the different organs are called *arteries*. By constantly subdividing, they become smaller and smaller, finally forming the *capillaries*, which can be seen only with high magnifying powers, and which no longer form distinct branches, but a sort of network. This network again collects into separate vessels, which gradually increase in size, finally forming large trunks which empty into the heart. The vessels which serve to carry the blood back again to the heart are called *veins*.

1. The Heart is a hollow, cone-like organ consisting of involuntary, striped muscle-tissue, the contractions of which serve to keep the blood in constant motion. It is an ingenious and marvellous pump. The apex of the heart (Plate V.) points to the left, forward and downward; its base, to the right, backward and upward. The position of the apex corresponds to an area in the space between the fifth and sixth ribs, just beneath the nipple. Here the apex impulse may be felt by the hand if the body is inclined slightly forward. When the contraction of the heart forces the blood into the arteries, the apex is thrown against the chest wall, just as a gun when fired recoils against the shoulder.

A dividing wall, composed of muscle and connective tissue, divides the heart into a left and a right half. A constriction, visible externally, divides each half into an upper cavity, the *auricle*, and a lower one, the *ventricle*, so that every heart is made up of four separate chambers, the two auricles and the two ventricles. The right auricle receives the blood from the upper half of the body through a large vein, the *superior vena cava*, and

that of the lower half of the body through another large vein, the *inferior vena cava*; while the blood from both lungs empties into the left auricle through the two left and the two right *pulmonary veins*. The large arteries of the heart, which carry the blood from the heart to the different organs, arise from the ventricles. The artery of the right ventricle, known as the *pulmonary artery*, divides very soon into two branches, which carry the blood to the left and right lung respectively. The artery of the left ventricle is the largest in the human body, and is called the *aorta*; it conveys blood to all the organs of the body except the lungs.

The current of blood is always in the same direction: from the veins into the auricles, from these into the ventricles, then into the arteries, and, finally, through the capillaries back again into the veins. The proper direction of the current is insured by the interposition of two sets of valves which close as soon as the blood tends to flow backward. One set of valves is placed between the auricles and ventricles; the one on the left side has two flaps and is called the *mitral* or *bicuspid* valve, whereas the valve on the right side has three flaps, wherefore it is known as the *tricuspid valve* (Plate VI. 1, 3). When the ventricles contract, both valves close, so that the blood cannot go backward into the auricles, but must flow into, and distend, the arteries. The reflux of blood from the arteries into the ventricles is prevented by three semi-lunar valves placed at the beginning of the arteries (Plate VI. 1, 2). The contraction of the ventricles forces the blood intermittently into the arteries, thus giving rise to the pulse, which can be easily felt with the fingers where a large artery runs a superficial course. A physician generally determines the quality of the pulse at the radial artery (see p. 155), which is readily felt near the outer side of the wrist-joint. From the arteries the blood is propelled into the capillaries by the contraction of the elastic walls of the former. The movement of blood in the capillaries is very slow, and it becomes still slower in the veins, where a certain amount of suction toward the heart takes place.

With regard to its action, the heart may thus be compared to two pumps working side by side—the right and the left hearts. The venous blood flows into the right auricle, which contracts and forces it into the right ventricle; this in turn forces the blood into the lungs to be oxygenated and to give off the impurities it has collected in its passage through the body. From the lungs the blood passes into the left auricle, and thence into the left ventricle, which again forces it into the aorta. The auricles and the ventricles contract rhythmically, first one, then the other. In some people and in some diseases the contractions of the auricles can be felt in the pulse as a faint wave. See HEART, DISEASES OF.

The pericardium is a membranous bag which surrounds the heart, and which enables it to contract and relax without friction. Large amounts of fluid may accumulate in this sac in disease.

The heart-muscle has the structure and properties of a striated muscle. It is not surprising, therefore, that it may show fatigue, as after severe bodily exertion or continued excitement. Individuals with fatigued heart-muscle become pale, because the heart no longer possesses the force to propel the blood through the vessels with normal rapidity. Sudden fatigue of the heart (as after prolonged swimming in cold water) may even cause fatal paralysis of the heart-muscle. Fatty degeneration of the heart, leading to disturbances in circulation and in general health, may follow after disease, over-exertion, or continued indulgence in alcoholic drinks.

2. The Arteries of the human body may be classed as belonging to the system of (a) the pulmonary artery, or (b) to that of the aorta.

The pulmonary artery (Plate V. 22) is a vessel the size and length of a thumb, which ascends perpendicularly from the right ventricle, along the left border of the sternum. It then divides into two branches, one for each lung. By means of this vessel, the dark red blood which is discharged into the heart by the *venæ cavæ*, and which is poor in oxygen and rich in carbonic acid, is carried to the lungs and again saturated with oxygen. The pulmonary artery is the only artery of the human body which carries dark blood.

The aorta (Plate V. 20) and all its branches, in contradistinction to the pulmonary artery, contain bright red blood, or blood rich in oxygen and poor in carbonic acid. At its origin the aorta has approximately the same thickness as the pulmonary artery, behind which it first runs upward and to the right. The succeeding portion describes a large curve, known as the arch of the aorta (Plate IV. 22), and then turns backward and downward through the chest and abdominal cavities. Opposite the fourth lumbar vertebra, the aorta is divided into three terminal branches: the middle *sacral artery* (Plate V. 34) which runs downward in front of the sacrum, and the common *iliac arteries* (Plate V. 14, 33), two large lateral branches, which run toward the thighs.

Throughout its course the aorta gives off a number of branches, the most important of which are the following:

(1) The *innominate artery* (Plate V. 2) consists of a trunk, about as long and thick as an average middle finger, which soon divides into two branches: the *right common carotid* (Plate V. 1) and the *right subclavian artery* (Plate V. 3). The former runs upward to supply the head; the latter describes a large curve, enters the axilla between the clavicle and the first rib, and carries blood to the right arm.

(2) The *left common carotid* (Plate V. 19) and (3) the *left subclavian artery* (Plates V. 21, and VII. 5) act like the corresponding arteries of the right side.

(4) The *intercostal arteries* originate from the descending thoracic portion of the aorta, and run laterally in the spaces between the ribs.

(5) The *lumbar arteries* arise from the abdominal aorta, and run laterally into the abdominal walls.

(6) The *two renal arteries* (Plate V. 10, 29) are short but prominent vessels, which supply the two kidneys exclusively.

(7) The *mesenteric arteries* (Plate V. 28, 32) are three unpaired vessels which run forward from the abdominal aorta, and carry blood to all the intestines.

The common carotid arteries (Plate VII. 3) lie in the depressions on both sides of the larynx, and may be felt through the skin. At the level of the Adam's apple each artery divides into the *internal* and the *external* carotid (Plate VII. 9, 10), the former for the brain and the latter for the rest of the head. A prominent artery of the head is the *superficial temporal artery* (Plate VII. 8), felt directly in front of the ear.

When each subclavian artery has passed underneath the clavicle and entered the axilla, it is termed the *axillary artery*. Lower down this vessel descends along the mesial side of the upper arm, where it is called the *brachial artery*. At the bend of the elbow this divides into two equally large branches, the *ulnar* and the *radial* arteries (Plate VIII. Fig. A 3, 10), which descend to the palm of the hand along the ulnar and radial sides of the forearm respectively. They are here connected by two prominent arches (Plate VIII. Fig. A 4, 11), from which the arteries of the fingers take their origin. On account of these arches blood will spurt from both ends of the vessel, if either radial or ulnar artery be injured near the wrist.

Both common iliac arteries (Plate V. 14, 33) divide, soon after their origin, into two branches: the *internal iliac artery* (Plate V. 15, 35) which runs into the true pelvis to supply the organs placed there, and the *external iliac artery* (Plate V. 16, 36) which descends next to the inlet of the pelvis, where it becomes the *femoral artery* (Plate VIII. Fig. B 5) beneath Poupart's ligament. The beginning of the last-named vessel is very superficial just where it passes underneath the middle of Poupart's ligament, and its pulsations can generally be felt with the fingers in the groin. The femoral artery continues its course along the mesial side of the femur to the popliteal space (the hollow at the back of the knee) where it is called the *popliteal artery*. At the lower end of this space it finally divides into the anterior and the posterior *tibial arteries*. The former takes its course between the extensor muscles on the front surface of the leg to the upper surface of the foot; while the latter runs along the back surface of the leg beneath the gastrocnemius, and then turns behind the mesial condyle to the sole. Like the corresponding vessels in the hand, the tibial arteries communicate in the foot by means of an arch, so that the blood from one can flow into the other when either is severed.

3. The Veins of the human body are much thinner and less elastic than the arteries. With the exception of the pulmonary veins, they also differ

from the latter in that they contain dark red blood, or blood poor in oxygen and rich in carbonic acid. The current of blood being much slower in the veins, stagnation is of frequent occurrence. This can easily be demonstrated by allowing the hands to hang down, when the veins will show as bluish strands or network, especially on the back of the hands. If stagnation becomes excessive in any one area, the walls of the veins may lose their elasticity completely, and become permanently dilated, so that they shine through the skin as bluish knots or very tortuous strands. Such dilated veins are known as *varicose veins*, and frequently cause painful cramps. The veins of the human body are either superficial or deep; the former are visible under the skin, the latter accompany the corresponding arteries. The following are the most important veins of the human body:

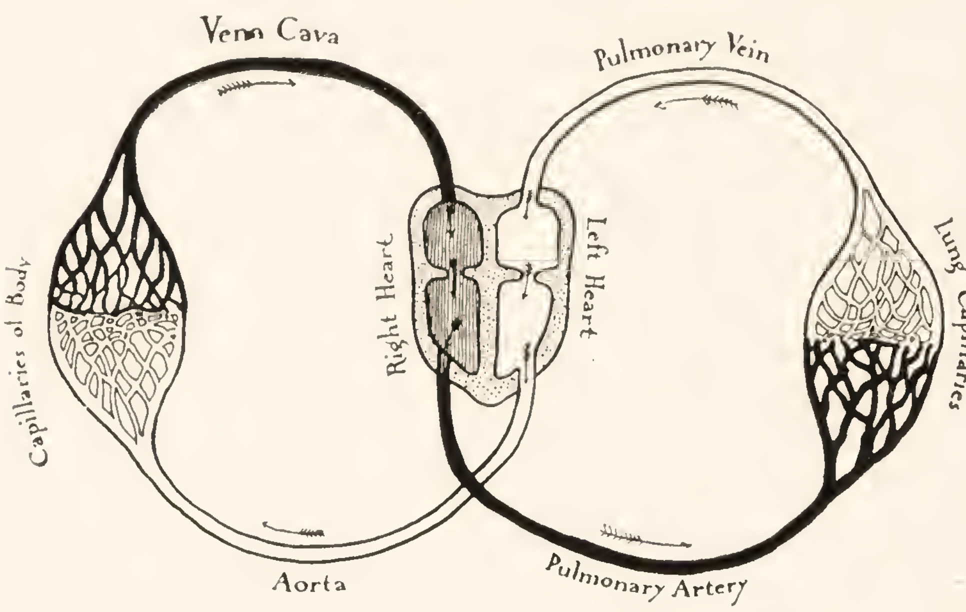


FIG. 57. Scheme of the circulation.

(1) The *superior vena cava* (Plate V. 4) lies behind the right edge of the sternum and carries the blood of the entire upper half of the trunk to the right auricle.

(2) The *inferior vena cava* (Plate V. 12) is placed in the abdominal cavity, to the right and in front of the vertebral column. It collects the blood of the entire lower half of the body, then runs through the diaphragm, and also empties into the right auricle.

(3) The *portal vein* is a very large vessel situated behind the pancreas and the duodenum. After collecting the blood from all the abdominal organs except the liver, it enters the latter organ at its lower surface. In the liver it splits up into a number of capillaries, which again unite, ultimately forming the hepatic veins, which join the inferior vena cava at the posterior border of the liver. The circulation in the portal vein is considerably slower than in the other veins, since the blood has to force its way through the fine capillaries of the liver before it gets into the inferior vena cava. Stagnation is therefore very common in the portal vein, and if it affects the veins of the rectum it gives rise to HÆMORRHOIDS.

(4) The two right and the two left *pulmonary veins* are short but comparatively thick vessels which empty into the left auricle soon after they leave the lungs. They are the only veins of the human body which contain bright red blood, rich in oxygen and poor in carbonic acid, their function being to return the oxygenated blood from the lungs to the heart.

The circulation of the blood through the body takes place as follows: Starting from the left ventricle, the bright red blood is first carried into the

aorta and then through its branches to all the organs of the body except the lungs. The oxygen is abstracted in the capillaries of the body and is used for the production of animal warmth, and for other metabolic functions. This process liberates carbon dioxide (CO_2), which is absorbed by the capillary blood. The veins which succeed these capillaries, therefore, contain dark red blood, poor in oxygen and rich in carbonic acid. This blood is carried to the right auricle through both venæ cavæ, and then past the tricuspid valve to the right ventricle. From here it is propelled, by the closure of the tricuspid and the opening of the pulmonary valves, through the pulmonary artery to the lungs, in whose capillaries oxygen is absorbed and carbonic acid given off, so that the blood again asumes a bright red colour. The succeeding course is through the pulmonary vein and left auricle into the left ventricle. From the left ventricle the blood again reaches the aorta to repeat the above course. As shown by the directions of the arrows in the accompanying cut (Fig. 57), the course described by the blood in its journey through the body is not a circle, but a figure " 8 " with its centre at the heart. The entire time that it takes for a given blood-cell to complete this circuit is about twenty seconds.

XI.—THE NERVOUS SYSTEM

The nervous system is divided into: (1) The central organs; (2) the peripheral nerves; and (3) the sympathetic nerve.

1. The Central Organs of the nervous system are the *brain*, contained in the skull, and the *spinal cord*, enclosed in the vertebral column (see Fig. 47). On cutting into either organ, a white and a grey substance may be distinguished. The grey substance contains the nerve-cells which are intimately associated with such mental processes as thought, perception, and volition; while the white substance is made up of the conducting tracts, which may be likened to telegraph-wires connecting the nerve-cells with the organs of the body. In the brain the grey substance forms a narrow layer placed on the outside, while the white substance is placed in the interior; in the spinal cord the opposite holds true.

The human brain is divided into three great parts: (1) the cerebrum; (2) the cerebellum; and (3) pons and medulla.

The cerebrum (Plate IX. 2, 6) forms the chief mass of the brain in man. Its grey, outer layer is the seat of intelligence and consciousness, of perception and volition. Recently, certain mental processes have even been localised in definite, circumscribed areas of this layer; and certain parts of the brain are now designated as speech centres, visual centres, and centres governing the motions of the upper and the lower extremities. The destruction of one of these centres will result in the loss of the power of speech, or of sight, or of movement of the upper or the lower extremities.

A deep impression running from the front backward divides the cerebrum into the left and right halves, or *hemispheres*. The division, however, is not complete, since both halves remain in communication by means of the so-called *corpus callosum*, which consists chiefly of fibres running from one half to the other (see Fig. 47). Owing to these fibres both hemispheres may act at the same time, or one hemisphere may vicariously assume the functions of the other when this is diseased or partially destroyed. The surface of the cerebrum has a peculiar appearance, owing to the presence of a number of furrows between which long elevations, the *cerebral convolutions*, are placed.

The cerebellum (see Plate IX. 3; and Fig. 47) consists, like the cerebrum, of two halves; but these are not as sharply set apart from one another, and the furrows and convolutions on their surfaces are less curved. The cerebellum contains nerve-cells, many of which preside over associated movements.

The pons and the medulla oblongata form the transition between the brain and the spinal cord. The *medulla oblongata* (Fig. 47, 13) may thus be regarded as the uppermost portion of the spinal cord, which projects into the skull. It contains the nerve-centres for respiration, for the heart and blood-vessel mechanism, and for many of the cranial nerves. The medulla, therefore, contains the most vital nerve-centres of the body.

The spinal cord (Plate IX. 4, 5) is a cylindrical structure, which breaks up into a number of nerve-strands in the region of the lumbar vertebræ. The outer, white substance is made up of those nerve-fibres which, issuing from the cerebrum and the cerebellum, run downward through the pons, the medulla, and the spinal cord. The internal, grey substance contains those nerve-cells which preside over the functions of the voluntary muscles, particularly their reflex activity. They also serve as important centres for the movements of the bladder, rectum, intestines, etc.

Both brain and spinal cord are enclosed in a number of membranes, among which the *dura mater* (Plate IX. 1) is the most superficial, and the best developed.

2. The Peripheral Nerves. As previously stated, the fibrous prolongations of the nerve-fibres, issuing from the central body of the nerve-cells, constitute the white substance of the brain and of the spinal cord. Collected into large strands they reach the surface of the body. Through constant subdivision the branches become finer and finer, and eventually terminate in end-organs (see p. 106). The nerves are called *cerebral* or *spinal*, depending upon whether they take their origin in the brain or in the spinal cord.

The cerebral, or cranial, nerves, form twelve pairs, which take their origin from the lower surface of the brain, or medulla, and emerge through the openings at the base of the skull. Important among these are

the nerves of special sense—namely, the nerves of smell (first), sight (second), hearing (eighth), and taste (twelfth). It has already been stated that each is capable of transmitting only one special sense. Another important nerve is the fifth, or *trigeminal nerve*, so called because soon after its origin it subdivides into three large branches (Plate XI. 1). Its chief function is to transmit painful sensations. The first branch runs into the orbit, and thence upward upon the forehead (Plate XI. 14); the second supplies chiefly the upper jaw and the upper teeth (Plate XI. 15), and the third, the lower jaw, with its teeth (Plate XI. 16). The pain-transmitting nerves of the skin of the face are also derived from the trigeminal nerve. All three branches are frequently the seat of a disease (so-called *neuralgia*) marked by paroxysms of pain; toothache involves one of the branches of this nerve. The tenth nerve, which is called the *pneumogastric* or *vagus nerve* (Plate XI. 3, 18, 20, 22, 23) describes the longest course of any of the cranial nerves. It is first placed next to the large vessels of the neck, then runs downward along the œsophagus, and supplies finally the stomach and the intestines. The pharynx, larynx, œsophagus, trachea, lungs, heart, and stomach are supplied by twigs from this nerve.

The spinal nerves form thirty-one pairs, which originate from the side of the spinal cord and emerge through the openings between the vertebræ (Plate IX.). From these arise the sensory and motor nerves of the rest of the body. After passing through the intervertebral openings they generally form coarse networks (or *plexuses*), and then break up into larger and smaller branches. Prominent plexuses are the *cervical* plexus (Plate X.) and that formed by the intercostal nerves (Plate XI. 7). The thickest nerve-strands are formed by the *brachial* plexus (Plate XI. 6), and by the *lumbar* and *sacral* plexuses. The first-mentioned gives rise to the nerves for the upper extremities, the other two to those of the lower limbs. A particularly prominent branch of the sacral plexus is the *sciatic nerve*. It runs along the back of the entire lower extremity to the sole of the foot; and it is well known also to the laity, since it is often the seat of a very painful disease (SCIATICA).

3. The Sympathetic Nerve (Plate XI. 4, 8, 9) occupies a special place among the nerves of the human body, since it consists chiefly of nerve-fibres in whose course many nerve-cells are interpolated. The principal trunk of the nerve (Plate XI. 4, 8) runs downward along the spine from the skull to the coccyx; and throughout its course it shows many nodular swellings consisting of nerve-cells. This principal trunk may be regarded as a third central nervous organ. By means of delicate fibres it stands in indirect communication with the brain and the spinal cord; and its branches surround the neighbouring arteries, together with the branches of which they reach almost all organs of the human body. The belief that this nerve established sympathy between the organs gave rise to its name.

The branches of the sympathetic nerve supply the many smooth muscle-fibres of the human body. It has already been stated that these smooth muscle-fibres are involuntary, and that they therefore contract without being influenced by the will. As examples, may be mentioned the contraction of the small vessels of the skin, and contraction of the stomach, intestines, and pupils. Although the sympathetic nerve exerts its function without, or even against, the will, it is to a certain degree dependent upon the brain and spinal cord, owing to the communicating fibres already mentioned. It is for this reason that contraction of smooth muscle-fibres may follow certain mental processes, causing, for example, pallor after fright or fear, and fainting from acute pain, the latter being often due to a sudden constriction of blood-vessels and consequent loss of blood in the brain.

XII.—THE ORGANS OF SPECIAL SENSE.

The organs of special sense are: (1) The eye; (2) the ear; (3) the organ of smell; (4) the organ of taste, placed in the mucous membrane of the tongue; and (5) the organs of touch, placed in the skin. Only the eye and ear will be described in detail here.

1. The Eye is the organ of sight. It lies in the orbit, and consists of the eyeball and its accessory parts, which latter either serve to rotate the eyeball or to protect it (see Figs. 58, 59).

The motor apparatus of the eye includes a number of muscles which act either singly or together, thus permitting of considerable freedom of motion. If one of these muscles becomes paralysed, the muscles acting in its opposite direction will give rise to SQUINTING. The muscles of the eye are regulated by the third, fourth, and sixth cranial nerves.

The protective organs of the eye are the eyebrows, eylashes, eyelids, and the lachrymal apparatus. The eyebrows protect the eye from the perspiration of the forehead; the eyelashes keep out irritating rays of light and small foreign bodies such as insects or dust. The eyelids are two movable curtains which are reinforced by two crescent-shaped pieces of cartilage. Behind, the eyelids are covered by a reddish mucous membrane, the *conjunctiva*, which forms a pocket and then turns over the outer surface of the eyeball itself. Particles of dust and coal are frequently caught in this pocket, and give rise to disagreeable irritation. If the lower eyelid is pulled downward, the shiny red conjunctiva may be inspected without difficulty. The so-called *Meibomian glands* are placed in the cartilages of the eyelids, where they elaborate a fatty secretion which reaches the surface at the free borders of the lids. The chief function of the lids themselves is to moisten the front surface of the eyeball, and thus prevent drying of the cornea of the eye. The chief lachrymal organ is the *lachrymal gland*, which is placed in the upper lateral corner of the orbits and secretes

the tears. These pass between the eyelids and the eyeballs to the inner angle of the eye, then through the lachrymal canals into the lachrymal sac, and finally into the nasal duct which runs downward along the mesial wall of the orbit, connecting the latter with the nasal cavity (see Fig. 58, *g*). All the tears thus reach the nose; and with abundant secretion, as after crying, it may be necessary to blow the nose frequently.

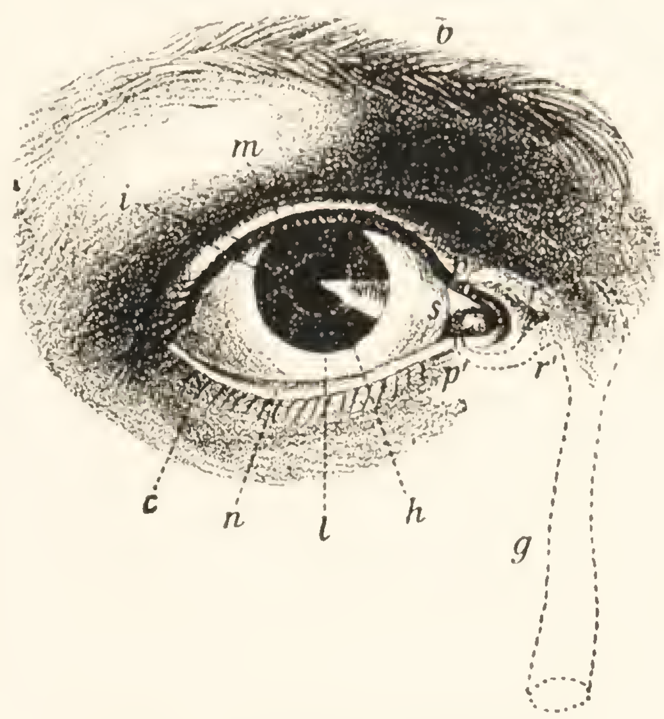


FIG. 58. The eye seen externally.

b, Eyebrow; *m*, *n*, eyelids with lashes; *h*, iris; *l*, pupil, with transparent cornea (*i*); *s*, sclerotica; *c*, conjunctiva; *p*, *p'*, upper and lower entrance to tear-ducts; *r*, *r'*, upper and lower lachrymal canals; *t*, tear-sac; *g*, tear-duct.

The eyeball consists of special refraction lenses supported by membranes. The latter are: (1) The *sclerotica* with its continuation, the *cornea*; (2) the *choroid* with its continuation, the *iris*; and (3) the *retina*, which is prolonged forward as the capsule of the *lens*. The sclerotic coat forms the "white of the eye," which shines through the *conjunctiva*. In front, it becomes the cornea, a perfectly transparent layer which does not interfere with the passage of light. The choroid coat and its continuation lie internal to the sclerotica and are abundantly supplied with pigment-granules and blood-vessels. The iris is easily visible through the transparent cornea, and is differently coloured in different individuals. Normally, it may show all shades between grey, blue, yellow, and black. In the iris of albinos, as in their hair and skin, there is a complete absence of colour, so that the fine blood-vessels shine through and give rise to a reddish tinge. See ALBINISM. In the centre of the iris is an opening, the *pupil*, directly behind which the front surface of the crystalline lens is placed. The function of the iris is to protect the eye from an excess of light so as to enable distinct vision. For this reason it is supplied with smooth muscle-fibres, which cause the pupil to contract or dilate. When bright light falls into the eye, a contraction occurs in order to diminish the supply of light; but in the dark the pupil becomes large, so that as much light as

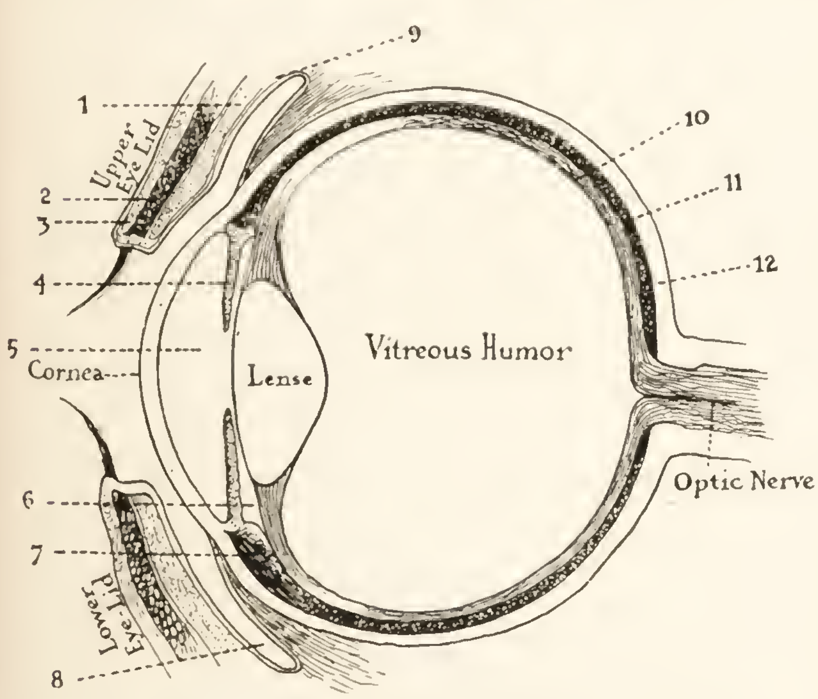


FIG. 59. Longitudinal section of the eye.

1, Cartilage of the eyelid; 2, orbicularis muscle; 3, external skin; 4, iris; 5, anterior chamber of eye; 6, posterior chamber; 7, muscle of lens; 8, conjunctiva sac; 9, conjunctiva; 10, retina; 11, choroid; 12, sclerotica.

possible may enter the eye. In the most anterior, thickened portion of the choroid there is a special muscular band, the *ciliary muscle*, which adjusts the shape of the crystalline lens for vision at different distances. The soft, brownish retina is placed internal to the choroid. It is made up chiefly of the expansion of the optic nerve, whose end-organs are very small nervous bodies, some of which are known as the *rods* and *cones*.

The light-refracting portions of the eye, excluding the cornea, are divided into (1) aqueous humour; (2) crystalline lens; and (3) vitreous humour. The *aqueous humour* is a watery solution of albumin, filling up the space between the cornea and the crystalline lens. This space is divided by the iris into two parts: a large anterior, and a small posterior chamber of the eye. The *crystalline lens* has the shape of a strongly bi-convex lens, and consists of a firm but elastic substance which can change its degree of convexity as the ciliary muscle contracts. The outer surface of the lens is surrounded by a transparent membrane (the capsule of the lens) which is attached to the choroid, and which follows all changes in shape on the part of the lens. The largest part of the eyeball is occupied by a jelly-like, transparent substance, the *vitreous humour*, which extends from the back of the lens to the retina.

The perception of light is due to the fact that the rays of light pass through the cornea, anterior chamber of the eye, lens, and vitreous humour, finally reaching the rods and cones of the retina, which are stimulated. By way of the optic nerve this stimulation is transmitted to the visual centre in the brain, where it gives rise to the sense of sight. In passing through the lens, the light-rays are refracted so that a small, sharp image is formed upon the retina. The normal curvature of the lens enables the formation of a clear image of a distant object. When an object close at hand is viewed, the contraction of the ciliary muscle increases the curvature of the lens so that the rays of light are refracted from a greater angle in order to form a distinct picture on the retina. In old age the lens generally loses its elasticity, and the eyeball flattens somewhat, so that the eye is adjusted only for far vision. In this condition, which is known as far-sightedness, objects at a distance may be seen clearly, while convex eye-glasses are required for near vision. An opposite condition is near-sightedness. This results when the image normally forms in front of the retina, and it becomes necessary for the patient to bring his eyes close to the object, thus spreading the angle of the incoming rays so that they will be thrown further back and on the retina itself. Short-sighted individuals must wear concave lenses which will spread the incoming rays and bring them to a focus further back in the eye. See EYE, DISEASES OF.

2. The Ear is the organ of hearing, and consists of three parts: (1) The external ear, (2) the middle ear, and (3) the internal ear (see Fig. 60). The greater part of this system is enclosed within the temporal bone.

The external ear includes the auricle and the external auditory canal, the opening of which is visible at the bottom of the former. The *auricle* is supported by the elastic cartilage of the ear; but its lowermost portion, the *lobule* of the ear, is merely a fold of skin padded with fat. The *external auditory canal* is surrounded externally by cartilage, and internally by bony walls; it ends at the drum-membrane, the partition between the external and the middle ear. The lining of the canal resembles the skin, and contains the so-called *ceruminous glands* which secrete a peculiar yellowish or dark-brown substance, the *ear-wax*. In some individuals this ear-wax accumulates to such an extent that it blocks up the ear canal and may cause deafness. The drum-membrane is a circular, white membrane placed obliquely, so that it forms an acute angle with the lower wall of the external auditory canal.

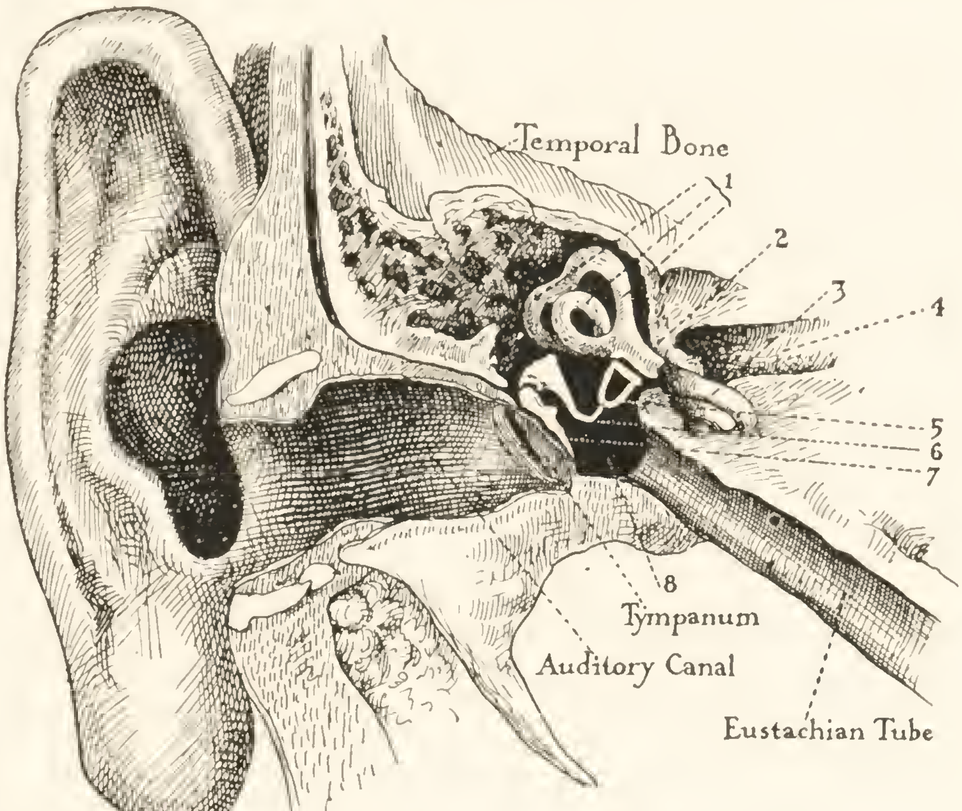


FIG. 60. The organs of hearing (partly schematic).

1, The three semicircular canals; 2, vestibule; 3, cochlea; 4, groove for the auditory nerve; 5, stapes; 6, incus; 7, malleus; 8, the tympanic cavity with the ossicles.

The middle ear, or tympanic cavity, is a small space which may be compared to a tambourine placed somewhat obliquely on its edge. The lateral wall is formed by the drum-membrane; the mesial wall, by the bony labyrinth (see following paragraph). Both walls are separated by a space only one-twelfth to one-eighth of an inch wide, which contains the three bones, or *ossicles*, of the ear: the *malleus*, the *incus*, and the *stapes*. These bones are connected by means of joints; so that they really form a chain of three links. The handle of the malleus is inserted into the drum-membrane; the incus is joined to the malleus, and the stapes of the incus. The plate of the stapes fits into an oval window in the labyrinth. In front and internally the middle ear communicates by means of the Eustachian tube with that portion of the pharynx which is situated behind the nose. From this it follows that if the drum-membrane is perforated, smoke may be blown into the middle ear through the Eustachian tube, and thence, through the opening in the membrane, out into the external auditory canal.

The internal ear, or labyrinth, is divided into a bony and a membranous portion. The *bony labyrinth* is a thickened portion of the temporal bone, and may be chiselled out of the latter; it contains a clear, pale fluid.

The *membranous labyrinth* is located within the bony labyrinth, and resembles the general shape of the latter; the end-organs of the auditory nerve terminate in its walls. The bony labyrinth consists of three parts: (1) The *vestibule*; (2) behind this, the three *semicircular canals*; and (3) in front of it, the *cochlea*. The membranous labyrinth is made up of a system of very thin-walled tubes and sacs which are also filled with fluid. The endings of the auditory (eighth) nerve upon its inner walls show a very complicated structure. The terminal organs are the so-called *auditory cells*, the free margins of which are covered with fine hairs.

Perception of sound takes place in the following manner: The sound-waves enter the external auditory canal and produce vibrations in the drum-membrane. These vibrations are transmitted along the chain of ossicles to the vestibule of the labyrinth, and thence along the semicircular canals and the convolutions of the cochlea to the round window of the labyrinth, which is closed by a thin membrane. Every sound-wave causes this membrane to bulge out toward the middle ear. As the waves travel through the labyrinth they irritate the hair-cells; and this irritation is transmitted through the auditory nerve to the centre of hearing in the brain, where it is perceived as sound. Every musical note seems to have a corresponding auditory cell, which is stimulated when that particular note is transmitted through the labyrinth.

XIII.—THE ORGANS OF GENERATION

The form of reproduction by which the human beings, as well as all higher animals, propagate, is a very complicated one which requires distinct organs of generation in the two sexes. The female organ generates the so-called *ovum*, or germ-cell, while the male organ develops the impregnating element called *spermatozoon*. From the union of these two elements results the new organism which during its uterine existence is nourished by a temporary organ, the *placenta*. The placenta consists of an arrangement of vessels which connect the maternal blood-vessels with the fœtus through the *umbilical cord*. Immediately after the expulsion of the fœtus the placenta is detached from the wall of the uterus, forming the larger part of the after-birth The following paragraphs contain detailed descriptions of the generative organs in both sexes:

The male organs of generation are the penis, the testicles and their ducts, the prostate gland, the Cowperian glands, and the seminal vesicles.

The *penis* consists of three somewhat flattened cylindrical masses of spongy tissue, containing numerous blood-spaces and capped by the conical glans. The two upper masses are placed side by side and are called the *cavernous bodies*. At the root of the penis these bodies separate, and run downward and outward along the pelvic bone. The third mass of tissue

is called the *spongy body* and is situated on the lower surface of the penis. Anteriorly it expands into the head, or *glans*, and internally terminates just within the body in another expansion called the *bulb*. The glans is a pyramidal body, flattened from above downward. Its projecting circumference is known as the *corona*. About the corona are situated many sebaceous glands, which secrete a modified sebaceous substance, the *smegma*. At the anterior extremity of the glans is the orifice of the urethra, or *lumen* of the penis; and just below this, between the glans and the under surface of the penis, is a little fibrous band, known as the *frænum glandis*. The skin is reflected from behind the corona down over the glans to form the *prepuce* or foreskin. The skin of the penis contains no fat.

The *urethra* runs through the spongy body. It is lined with mucous membrane, and is surrounded by a small amount of muscular tissue. Back of the bulb it is somewhat constricted in passing through a double fibrous membrane, the *triangular ligament*, and then continues through the prostate to the bladder. The mucous membrane of the urethra is continuous with that lining the various genital glands and ducts, and through the bladder with the upper urinary tract.

The *Cowperian glands*, or Cowper's glands, are two small, yellowish bodies about the size of peas, placed just in front of the prostate, between the two layers of the triangular ligament, at which point they empty into the urethra. They are composed of minute lobules arranged somewhat like a bunch of grapes, and secrete a fluid which contributes to the seminal discharge.

The *prostate gland* is a firm, glandular body, somewhat the shape of a chestnut, placed immediately in front of the neck of the bladder and around the commencement of the urethra. Its base is about an inch and a half in diameter, and is directed upward and backward toward the bladder, the apex pointing downward and forward. It is about an inch behind and below the anterior bony border of the pelvis, while its posterior surface can easily be felt through the rectum. It is composed of three lobes: two lateral ones which unite in front, and a smaller central lobe which is situated beneath the neck of the bladder and behind the urethral orifice. The gland is made up of involuntary muscular tissue, and of numerous secreting follicles, which are drained by a system of tubules and empty through twelve to twenty little ducts opening into the urethra. The secretion of the prostate also forms part of the spermatic fluid.

The *testicles* are highly specialised glands which secrete the essential part of the seminal fluid. They are oval bodies, somewhat compressed laterally, and are suspended in the *scrotum* by the *spermatic cords*. The left testicle hangs somewhat lower than the right, its spermatic cord being a little longer. Each testicle is enclosed within a dense fibrous capsule and is surrounded, except posteriorly, by a sack (the *tunica vaginalis*) which

contains a small amount of lubricating fluid, so that it is freely movable within the scrotum and is thus less liable to injury. Between this sack and the skin are four layers of tissue, more or less intimately united, which divide the scrotum into two cavities for the two testes. One of these layers, the *cremasteric fascia*, is largely composed of muscle-fibres, and to this is due the power of the scrotum to retract under certain conditions.

The fibrous capsule enveloping the testicle sends processes into the gland, dividing it into many lobules. Each of these lobules contain several minute secreting tubules, from whose lining originates the *spermatozoon*, the male cell necessary to fertilisation. These tubules are drained by a rather complicated system through the *epididymis*, a small organ situated on the posterior aspect of the testicle, into the *vas deferens*. The vas deferens is a tube which ascends as part of the spermatic cord, and passes through the abdominal wall to the base of the bladder.

The *spermatic cords* are composed of the vas deferens, blood-vessels, lymphatics and nerves, and a thin fibrous cord. The most noticeable constituent is the convoluted mass of veins. As the *vasa efferentia* near the urethra they are joined by the ducts of two slender membranous pouches, called the *seminal vesicles*. These pouches are about two inches in length and are situated between the base of the bladder and the rectum. They serve as reservoirs for the semen, and contribute more or less fluid to that mixture. The vasa and seminal vesicles on each side, joining, form the *ejaculatory ducts*, which run through the prostate for about three-quarters of an inch, to discharge their contents into the urethra.

The female organs of generation may best be treated under two headings, the external and the internal organs. The external organs are known under the term *vulva*, and include the mons Veneris, labia majora, labia minora, clitoris, vestibule, hymen, and fourchette.

The *mons Veneris* is a slight elevation composed of fat, which is situated over the anterior junction of the pelvic bones. Below this point two prominent folds of skin are seen extending backward and diverging slightly. These are the *labia majora*. They unite in front forming the *anterior commissure*. Posteriorly they diminish in size, and disappear in the surrounding tissue without meeting or coming to an abrupt end. The line connecting their posterior extremities is spoken of as the *posterior commissure*. The outer surfaces of the labia majora are not unlike the skin in other localities, but the inner surface and all structures enclosed by them are smooth and pinkish. Overhung by the labia majora are two smaller folds of skin known as the *labia minora*. These also start at a common point anteriorly and diverge posteriorly.

At the anterior junction of the labia minora is situated the *clitoris*. This organ is analogous to the penis in the male. It is composed of spongy erectile tissue and sends processes corresponding to the cavernous bodies

down along the arms of the pelvic bones. The anterior extremity of the labia minora forms the *frænum clitoridis.* The glans is often hidden from view by the prepuce. A venous plexus corresponding to the spongy body of the penis underlies the labia minora. Anterior to the orifice of the vaginal canal is a triangular area, bounded laterally by the labia minora. This is called the *vestibule.* The orifice of the urethra is situated about in the centre of this triangle.

Just posterior to the vaginal orifice is a slight boat-shaped depression called the *fossa navicularis.* The space between this depression and the anus constitutes the *perineum,* its anterior edge being called the *fourchette.* The orifice of the vagina is partly occluded by a membranous structure called the *hymen.* Behind the hymen, on either side of the vagina, lies a small gland about the size of a bean. These are the *vulvo-vaginal glands.* Their ducts empty just externally to the hymen.

The internal organs of generation in the female are the vagina, the uterus, the Fallopian tubes, and the ovaries.

The *vagina* is the canal extending from the vulva upward and backward to the uterus. Its anterior wall is about two and one-half inches in length, and the posterior wall three and a half inches. It is lined with modified skin which much resembles mucous membrane, and which contains numerous mucous crypts. The surface is interrupted by transverse ridges and small conical projections. Surrounding this inner layer are many large veins, forming a plexus which acts more or less as erectile tissue. The layer of veins is enclosed in a muscular coat composed of an inner circular and an outer longitudinal layer of involuntary muscle. Surrounding the lower end is a band of voluntary muscle. The vagina is situated between the bladder and urethra in front and the rectum behind, and pierces the powerful levator muscle—the sling of the pelvis, upon which so much depends for support.

The *uterus,* or *womb,* is a hollow, muscular organ, somewhat pear-shaped and flattened anteroposteriorly. It is about three inches long, two inches broad at its upper end, and an inch thick. Although quite movable, its usual position is with its top tipping forward, just below the brim of the pelvis, and the lower part inserting into the vagina at an angle of about 90 degrees. By a slight constriction it is divided into two parts, the body, or *fundus,* being above and the neck, or *cervix,* below. The lower part of the cervix protrudes into the vagina, and has at its apex a small aperture, the *os,* or mouth of the uterus. The cavity of the uterus is triangular in shape and flattened from before backward. The opening of the cervix is spindle-shaped, being constricted at each end. The junction of the cervical canal and the cavity of the uterus is called the *internal os.* At the upper corners of the uterus the cavity connects by two very small openings with the *Fallopian tubes.*

The uterus is lined with true mucous membrane. At the lower portion of the cervix the cells are flat or squamous epithelium arranged in layers. In this locality there are numerous short mucous crypts which often become occluded and, filling up with their own mucoid secretion, form little cysts. The upper half of the cervical canal and the cavity of the uterus are lined with what are known as *ciliated columnar cells*. On the surface of these cells are many little hair-like processes, or *cilia*, which are in constant motion. Waves of movement sweep rapidly over the entire surface like grain bending before the wind. This produces a current in the direction of the cervical outlet. The mucous membrane contains many deep tubular glands, also lined with ciliated cells.

The greater part of the uterus is made up of involuntary muscle of rather complex arrangement, and very rich in blood supply. For three-quarters of its extent in front, and completely behind, it is covered by the lining membrane of the abdomen, the *peritoneum*. The uterus is supported and held in position by eight so-called ligaments. All these, except the two round ligaments, are folds of the peritoneum. The peritoneal fold turning up from the anterior surface of the uterus over the bladder is the *vesico-uterine pouch*; posteriorly, as the peritoneum is reflected over the rectum, it forms the *recto-uterine ligament*. Between the uterus and the rectum is a peritoneal pouch whose lateral walls form the *sacro-uterine ligament*. The uterus is connected laterally with the pelvic walls by folds of peritoneum called the *lateral ligaments*. Together with these lateral ligaments the uterus thus forms a transverse partition, dividing the pelvis into two parts. The bladder and the urethra occupy the anterior part, while the rectum fills the posterior part.

Between the two layers of the broad ligament are situated the round ligaments, the Fallopian tubes, the parovarium, muscular and fibrous tissue, and vessels and nerves. The *round ligaments* are two fibrous and muscular cords within the lateral ligaments. They begin near the superior angle of the uterus and pass upward, outward, and forward to the abdominal wall. This they penetrate like the spermatic cord in the male, and insert in the tissue of the labia majora. They are four or five inches in length.

Along the upper free borders of the lateral ligaments lie the *Fallopian tubes*. Each tube is about four inches in length, and extends outward from the upper angle of the uterus toward the lateral pelvic wall, its free end drooping down over the ovary which lies beneath the tube on the posterior surface of the lateral ligament. The inner portion of the tube is quite constricted, but it enlarges as it passes outward. The end is surrounded by finger-like processes, the *fimbriæ*, one of which is attached to the ovary.

The tube is lined with ciliated cells. At its outer end it opens into the peritoneal cavity and at its inner end into the cavity of the uterus, so that through the tube, uterus, and vagina, there is a direct communication from

the abdominal cavity to the outer world. It is through this channel that the female germ-cell, or *ovum*, passes, after having been thrown off by the ovary. Propelled through the tube by the ciliary action of its lining cells, it may eventually meet the male cell and develop within the uterus, or else pass off through the vagina with the menstrual discharge. Surrounding the mucous membrane of the tube are two layers of muscular tissue, an inner circular and an outer longitudinal layer. This muscle is continuous with that of the uterus. The tube is enveloped, except at its free end, by the peritoneum.

The *parovarium, or epoophoron,* is a small tubular structure in the lateral ligament. It is the remains of a fœtal organ, and has no practical significance in the healthy adult.

The *ovaries* correspond to the testicles in the male. They are flattened, oval bodies about an inch in length, situated on either side of the uterus, on the posterior surface of the lateral ligaments. They are attached to the uterus by a short ligament arising from its lower end, and are enclosed in a reflection of the peritoneum from the lateral ligament. In appearance this covering is, however, somewhat different from the ordinary peritoneum, being a dull grey in colour.

The substance of the ovary is largely loose, soft, connective tissue, rich in blood supply. The tissue is condensed at the periphery into a firm covering. The outer third of the ovary is called the *cortex*, the central part the *medulla*. Scattered through the tissue of the cortex are numerous little globules, varying from $\frac{1}{100}$ to $\frac{1}{4}$ of an inch in diameter. These are the *Graafian follicles,* the homes of the immature ova. As the ovum matures, certain changes take place in the Graafian follicle, which gradually enlarges until its diameter includes almost the entire cortex. It finally forms a projection on the surface of the ovary and bursts at this point, allowing the mature ovum to escape and find its way into the fibrinated extremity of the tube. This usually coincides with the period of menstruation.

Besides the Graafian follicles the ovary contains little yellow bodies in various stages of development. These are the remains of the Graafian follicles that have discharged their contents and are undergoing degenerative changes.

GENERAL REMARKS ON DISEASE

I.—NATURE OF DISEASE

Any departure from the normal performance of natural functions is defined as disease. The abnormal variations may be so very evident that even a layman may detect them at a glance. External injuries are very easily diagnosed; and even internal ones may often be readily recognised, as when foreign matter, such as blood, is passed from the nose, ear, or intestines. Abnormalities in the shape of organs (swelling, thickening, curvature, induration, atrophy, etc.) may also be very noticeable, if they have not existed before. The functions of the different organs may also be accompanied by marked disturbances, such as cough and expectoration, vomiting, diarrhœa, shortness of breath, increased body-temperature, convulsions, delirium, etc.

On the other hand, an individual may be sick in spite of the fact that nothing morbid may be detected at examination. Certain affections are not accompanied by marked changes in the organs, and manifest themselves only at certain intervals. Epilepsy, for example, attacks at intervals of a month or more; and gall-stones are accompanied only by occasional paroxysms of pain when a stone is caught in the passages. This stone cannot always be detected by the common methods of examination.

Disease always relates to a disturbance of the functions of body or mind, although such disturbance may be apparent only under certain conditions. The underlying cause of disease is some abnormality in the organic structure and functions; and every disease is dependent upon changes in the physiological workings of some special organ or organs. In very many instances the disease remains restricted to one particular organ; and various diseases are therefore classified and described according to the organs affected. Distinction is thus made between diseases of the skin, of the muscles, of the bones, the nervous system, the lungs, the heart, the blood-vessels, the kidneys, the genito-urinary apparatus, and the digestive organs, etc.

The seat of disease may be localised even still more accurately in many instances, since it can almost invariably be determined which part of the organ is particularly involved. In the case of a cold in the nose, for instance, the cells of the nasal mucous membrane are converted into mucus and are thrown off, while the blood-vessels secrete a thin, watery or purulent fluid.

In that form of tumour which is known as *sarcoma*, the cells common to connective tissue continue to increase in number until large growths result. These push aside normal structures of the body, and may eventually cause death if they spread in important vital organs. In cancer of the stomach, the cells of the mucous membrane of that organ proliferate in a like manner, forming more or less firm swellings which may block the entrance to the intestines. Constant vomiting, and death by starvation may be the consequence. The peculiar disease known as *leucocythemia* is a result of an affection of the blood-forming organs (bone-marrow and spleen), which causes an enormous increase in the number of white corpuscles ; in severe cases, decrease in number and alteration in shape of the red cells will follow.

That many diseases are of local origin is a theory which is in perfect accord with the experience gained at autopsies, operations, during microscopical examination of organs, and while observing the course of affections. An impoverished condition of the blood is usually not the cause, but the consequence of illness, and in the majority of cases it does not play a prominent part. Charlatans, natural healers, etc., still regard the humours of the body as being of great importance ; not because they have any proofs to support their views, but because they don't know any better. If one be guided by facts and not by conjectures, the local origin of disease must be conceded. It will then be evident that a careful examination of the different organs is absolutely necessary in order to detect the seat of the disease and to treat it properly. For this purpose, a knowledge of the anatomy of the organs in health and disease, and experience in the more difficult methods of examination (ophthalmoscopy, laryngoscopy, etc.) are essential.

The fact that two or more diseases may affect the same body simultaneously, is another illustration of the local character of disease. It is possible for an individual to suffer at one and the same time from consumption, gall-stones, and ulcer of the stomach ; or to be attacked simultaneously by dyspepsia, gout, and stones of the kidney. It is therefore difficult to understand how Hahnemann, the father of homeopathy, could state that all diseases are general, not local, and that two diseases cannot invade the same body at the same time. Almost every autopsy convinces one of the absurdity of this view. Equally ridiculous theories are advanced by many quacks. Some of them state, for instance, that every disease is due either to disturbances in the circulation of the blood or to a change in its composition. In order to cure disease the blood must be made to circulate properly, or the impure substances must be excreted.

The danger of such sweeping statements can be seen from the following example. In order to win a bet some individual eats an enormous meal and drinks an excessive amount of beer. Extreme distention of the abdomen follows, and the patient becomes seriously ill. True to his theory,

the quack who has been hurriedly summoned directs his attention to the disturbed circulation and to the noxious products which are supposed to clog the blood. He may order applications to the abdomen "to stimulate excretion," or foot-baths "to cause depletion," and perhaps an enema of a certain size and temperature "to remove the excess of food." This treatment will most likely be fatal to the patient. A physician, on the other hand, will try to discover the seat of the disease and treat it accordingly. His experience in examination soon convinces him that only something in the stomach could cause such enormous distension of the abdomen. He remembers from his anatomical studies that over-filling of the stomach closes that organ both toward the œsophagus and the duodenum. The stomach is therefore unable to relieve itself either by spontaneous vomiting or by propulsion of the food toward the intestines; and the condition of the patient must rapidly grow worse, owing to fermentation of the gastric contents. The physician therefore at once introduces a stomach-tube and washes out the stomach so as to rid it of all injurious matter. The patient is fed by the rectum for one or two days, so that the over-distended stomach may return to its normal state. At the end of this time the patient will have recovered. Here treatment of the local disease—acute dilatation of the stomach—will save the patient's life; whereas he who bases his treatment on the idea that the general pallor, the cold perspiration, and the rapid pulse are due to a disturbance of circulation (which is the *consequence*, and not the *cause* of the condition) will kill the patient.

Another example may be mentioned: An exceedingly pale and weak individual consults a natural healer, who advises him to eat fruits and green vegetables, and to take sun-baths, general massage, etc., in order to improve the blood. The patient's anæmic condition, instead of improving, steadily grows worse. The physician who is now summoned endeavours to determine the cause of the impoverished condition of the blood. On examining the stool of the patient with a microscope he soon detects the eggs of a certain kind of tape-worm. This worm may be expelled by proper remedies, and the patient will recover without further treatment. Nobody can therefore doubt that the nature of a disease determines the course of treatment; and the same remedies can never apply to all cases. And it is equally as ridiculous to attribute all ills to humours or to deteriorated blood.

Certain diseases, however, affect the greater part of the body, even all the organs, through the blood or the lymph. When, for example, a person attempts suicide by drinking carbolic acid, the mucous membranes of the mouth, œsophagus, and stomach are first intensely burned, whereupon a severe catarrh sets in. The poison is then taken up by the blood-vessels, so that it reaches all organs, causing changes in them that interfere with their proper functions; and as a result of the loss of these functions the patient dies. An accumulation of pus may, likewise, find its way into the

blood, so that the germs which cause the suppuration reach other organs and form new collections of pus. This may result in a general formation of abscesses and thereby cause death.

The entire body is affected also in those diseases which are accompanied by fever. Fever is a disturbance of those nervous centres which regulate the temperature of the body, and it is generally caused by chemical poisons or by the poisons of germs. The generation of heat is increased during fever, and hence the body temperature rises and the heart beats faster. A certain degree of fever may be an advantage, since it causes the germs to propagate less actively, and also because the increased vital processes form substances which tend to neutralise the poison of bacteria. It does not follow, however, that fever should not be treated. A temperature of 107°—108° F. causes changes in principles that are essential to life; and a fever of this degree must, therefore, be reduced as speedily as possible.

II.—CAUSES OF DISEASE

The following causes of disease are recognised :

1. Mechanical Causes. Among these may be mentioned fractures of bones, resulting from severe blows or falls ; injuries from stabbing or cutting, etc. This class includes also wearing apparel which will cause deformities if worn for a long time. Tight shoes, for example, may cause deformities of toes and feet ; while deformity of the thorax, and prolapse of the abdominal organs may result from tight lacing.

2. Chemical Causes. These include cauterisation of the œsophagus from drinking corrosive acids ; poisoning from tainted meat ; lead poisoning from the use of inferior cooking utensils ; slow poisoning with mercury, tobacco, etc. Of great importance are also the changes which occur in the various organs from the continued, excessive use of alcohol. This affects most organs, causing shrinkage of liver and kidneys, enlargement of the heart, and diseases of the stomach, intestines, brain, nerves, etc.

3. Physical Causes. Extreme heat or cold may lead to burns, frost-bite, sunstroke, or colds. Electrical discharges may cause burns, or other injuries due to the passage of strong currents through the body. Sudden diminution of air-pressure may lead to hæmorrhages. Exposure to strong light may cause blisters and burns. Certain phenomena of the nervous system occur with changes in the pressure, moisture, or electrical tension of the atmosphere.

4. Deficient Food. Deficiency of lime is injurious to the bones. Deficiency of air and light affects the entire body (see, for example, RACHITIS).

5. Excess of Food. Excessive ingestion of fatty or starchy food may lead to obesity ; of indigestible food, to relaxation of the stomach. Abnormally

large amounts of fluid (beer) are responsible for hypertrophy of the heart.

6. Overstrain of Organs. Every organ is injured by overstrain; but a single excess, followed by the necessary rest, is less harmful than a continued strain, which does not allow the body to recuperate. Excessive

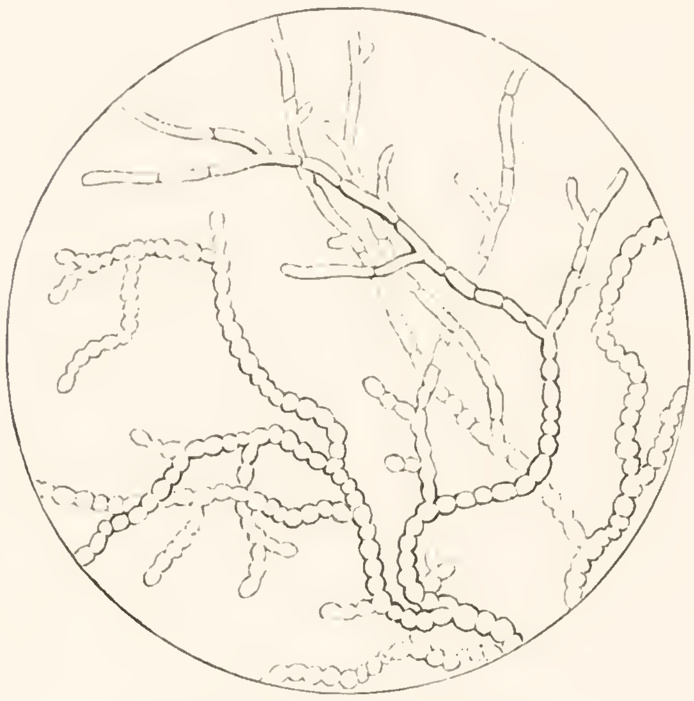


FIG. 61. Fungus of ringworm.

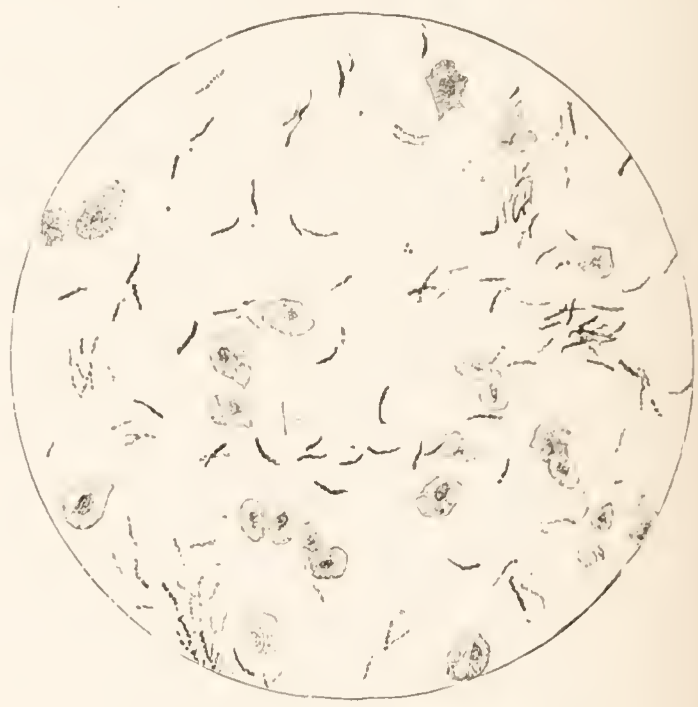


FIG. 62. The tubercle-bacillus.

bicycling, for example, may cause heart-failure; while mental overstrain often demanded by present social conditions, frequently leads to serious disorders of the brain or of the nervous system.

7. Insufficient Activity of Organs. A certain degree of activity on the part of the organs is absolutely essential to health. The muscles, for

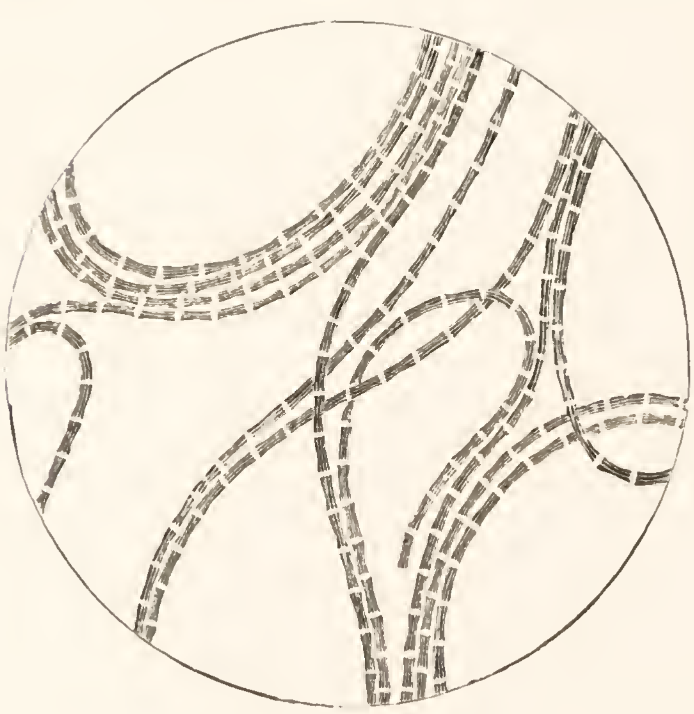


FIG. 63. The anthrax-bacillus.

FIG. 64. Streptococci.

instance, cannot remain strong unless they are constantly in use. If an extremity is kept immovable for a long time, as by reason of a fracture, the muscles of that extremity will atrophy as a consequence.

8. Influence of Diseased upon Healthy Organs. Certain organs are so intimately related that a disordered condition of one reacts upon the other.

Thus, contraction of the kidneys and calcification of the arteries lead to hypertrophy of the heart. A blood-clot obstructing an artery (see Plate VI. 2) may be carried to other vessels and clog these also; if the obstruction affects the vessels of important organs (heart, lungs, brain) sudden death may follow. See VEINS, INFLAMMATION OF.

9. Psychic Influence. Constant worry leads to emaciation. Violent fright may cause convulsions, paralysis, or even sudden death. Intense mental suffering may cause insanity in predisposed individuals.

10. Heredity. It would lead too far to discuss this subject in all its bearings. It must suffice to say that deformities, disposition to certain

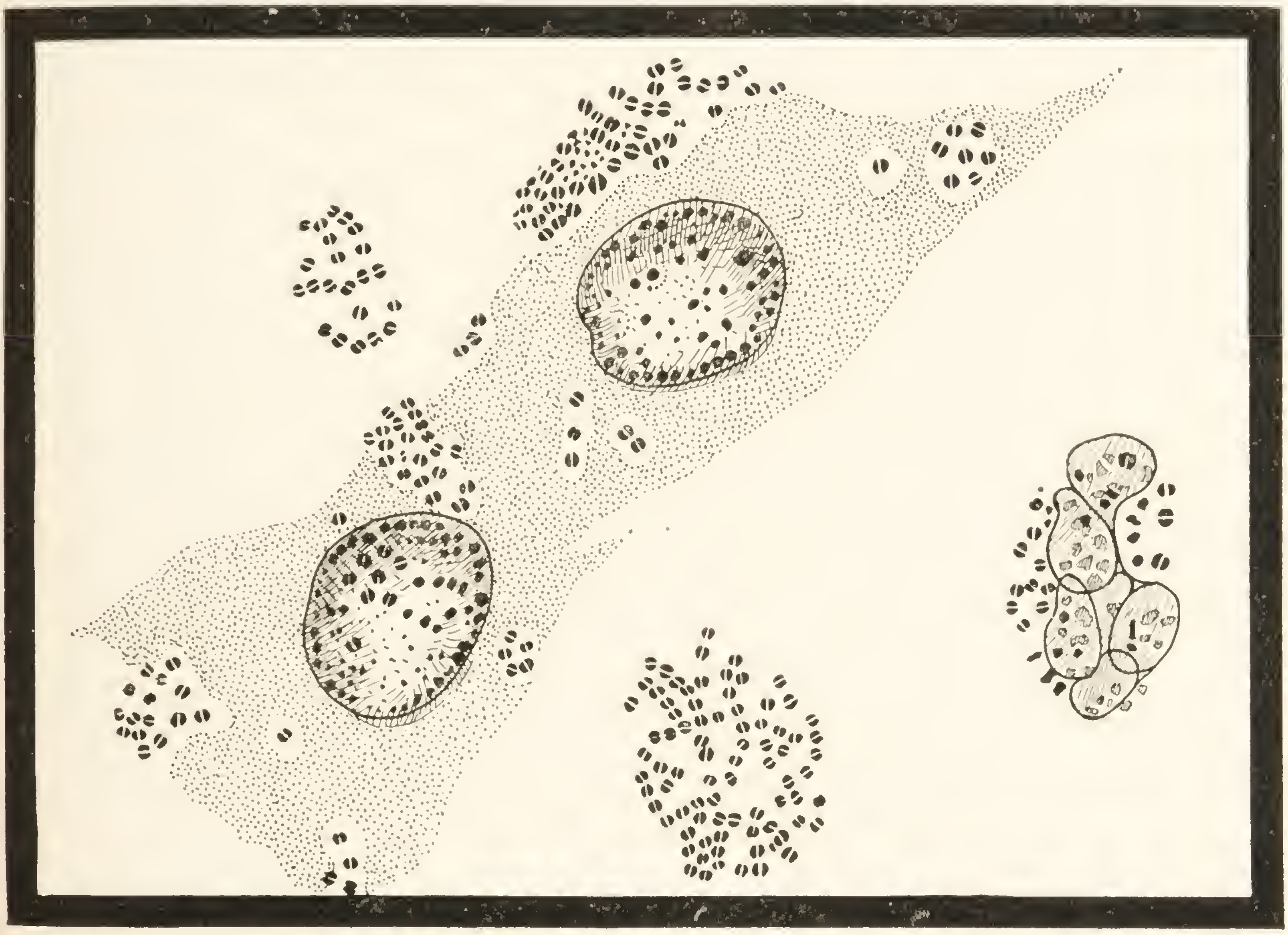


FIG. 64A. Gonococci (the cause of gonorrhœa).

tumours, as well as many diseases (such as gout, migraine, and mental disorders) are inheritable. Susceptibility to certain external influences, a condition known as idiosyncrasy, is also frequently inherited; as examples may be mentioned a disposition to get nettle-rash after eating crabs or strawberries, and intolerance to certain drugs (as cocaine, iodine, morphine, etc.).

11. Contagion. Infection is caused by parasites which enter the body and propagate at its expense. Common vegetable parasites are certain moulds, as the *Achorion Schoenlenii* which settles upon the hairy scalp (see FAVUS), and the *Trichophyton* (Fig. 61) which is responsible for a common skin disease popularly known as ringworm. The body may be invaded also by yeast-cells, as the *Oidium albicans* which gives rise to thrush in small children. Parasitic animals well known among the laity are the

itch-mite (see SCABIES), the trichina (see TRICHINOSIS), and the tapeworm (see TAPEWORM).

The most important organisms responsible for disease are, however, so small that they can be seen only if magnified 500 to 1,000 times. They are minute, fungus-like plants; and, according to custom, they are called either microbes, or bacteria, or germs. According to their shape they are divided into rods (*Bacterium* or *Bacillus*; see Figs. 62, 63), spheres (*Coccus*; see Fig. 64), and spirals (*Spirillum*; see Fig. 65). Depending upon their action upon the human or animal body, they may also be classified into those that are harmful, or pathogenic, and those that are harmless, or non-pathogenic. The entire intestinal tract, from the mouth to the anus, harbours millions of such harmless bacteria, which help to break down the food so that it can be more readily acted upon by the digestive juices.

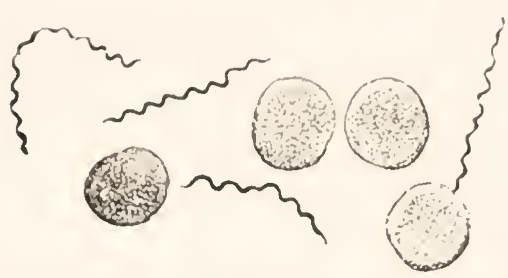


FIG. 65. Spirillum of relapsing fever.

The most important disease-producing bacteria are: (a) *Cocci*: The Coccus of pus, of erysipelas, of gonorrhœa (see Fig. 64A), of pneumonia, and of trachoma, etc. (b) *Bacilli*: The Bacillus of anthrax, of diphtheria, of typhoid, of tuberculosis, of influenza, of leprosy, and of the plague. (c) *Spirilla*: the Spirillum of Asiatic cholera, and that of relapsing fever. This list, however, does not include all these parasites.

There is a class of one-celled micro-organisms, belonging to the animal rather than to the vegetable kingdom, and possessing a more complicated life-history than the bacteria. They are called *Protozoa*, and some of them are unquestionably the cause of malaria, while others give rise to certain forms of tropical dysentery (see Fig. 66). Certain diseases in cattle are due to minute animal forms; so also is the peculiar African disease known as the *sleeping sickness*.

Certain diseases occur only in definite localities. Thus, MALARIA (which see) is common in the neighbourhood of certain swampy regions, the disease being transmitted through the bite of mosquitoes, which develop in such places, and which alone can inoculate the parasite from man to man.

FIG. 66. Amebæ from the intestine.

That bacterial organisms are the cause of disease is proved by the following general facts: (1) They may always be detected in the diseased organs of patients suffering from the disease in question. High magnifying powers and special staining methods are generally necessary to identify such bacteria under the microscope. (2) The bacteria may be cultivated from the diseased organs. For this purpose they are inoculated into special

culture-media, upon which they will multiply if kept moist and warm. Such culture-media are broth, blood, or solid media (potatoes, gelatine, or agar-agar boiled in broth and solidified on cooling). (3) Cultures of bacteria may be injected into healthy animals, in which they will give rise to symptoms similar to those observed in the original disease. (4) The original bacteria may again be obtained in pure culture from the infected animals. These laws of evidence have been termed Koch's Laws.

III.—ORIGIN OF DISEASE

It is not difficult to understand how disease originates, if the disease process is looked upon as a reaction between the cause of the disease and the body. The same cause may produce symptoms of varying severity. Thus, insufficient food may lead to death by starvation in a short time; or it may affect only one constituent of the body, the red colouring matter of the blood, so that only a moderate degree of anæmia results. Complete lack of sleep for several days and nights may be rapidly fatal; while a slight shortening of the period of sleep may result only in a moderate degree of neurasthenia. The same holds true for poisons. Large doses of poisons cause acute symptoms, and possibly death; whereas small, continued doses give rise to altogether different symptoms of slowly developing disease. The same rule also applies to bacteria. Even the very same kind of bacillus may have different degrees of virulence in different individuals. This varying degree of virulence may thus determine the character of an epidemic. In certain epidemics of scarlet fever and diphtheria, for instance, the affected are seriously ill and the mortality high; while in other epidemics the disease runs a mild course and but few patients die. By special methods of cultivating bacteria, physicians are able to increase or diminish their virulence, and can thus develop protective antitoxins, etc., with less danger to the producing animals.

Difference in the severity of a disease may be due also to varying predispositions on the part of the patients. The importance of predisposition has been long recognised by physicians, and has been confirmed by many convincing instances. The following statements can be made concerning predisposition:

(1) Different organs are not equally susceptible to the same disease. Tubercle-bacilli, for example, if injected into the blood of an animal, will cause tuberculosis of the brain, lungs, and digestive organs, but never of the muscles; the reason for this is that lactic acid is formed in the muscles, and tubercle-bacilli cannot multiply upon an acid medium. Trichinæ migrate into striated muscles but never into other organs. Strychnine injected into an animal will affect only the cells of the central nervous system; etc.

(2) The susceptibility of the same organ varies at different times. The

intestinal tract is more predisposed to cholera if a moderate catarrh is present owing to errors in diet. Cancer is more apt to develop in an ulcerated stomach than in a normal stomach. The susceptibility may also be varied by appropriate measures.

(3) The susceptibility of the same organ or tissue differs in different individuals. Here inheritance plays an important rôle. This is especially marked in consumption, mental diseases, and certain nervous affections which occur in whole families.

The cause of every disease must, therefore, act upon the organism; and the intensity of the cause must stand in a certain relation to the susceptibility of the affected body. If the disease-producing factor is very intense, disease will almost invariably be the consequence. Sufficiently virulent bacteria will kill healthy laboratory animals with such mathematical precision that bacteriologists may estimate the actual body-weight of a dog, rabbit, or other animal, which will be killed by a certain culture of bacteria in a definite number of hours.

The prevention of diseases caused by bacteria is better accomplished by avoiding transmission and by combating the bacteria themselves, than by altering the susceptibility of the body. Marked advance in hygiene (sanitary science) and in the prevention of wound-fever has thus been rendered possible. Surgeons will testify that vegetarians are equally as susceptible to wound-infections as are those who live on meats; and hardly anybody would think of trying to prevent such infections by diminishing the susceptibility of his body. It is far more logical that the surgeon prevent the infecting germs from entering the wound. This may indeed be done in most cases, so that major operations may be attempted even on such organs as heart, brain, lungs, and the organs of the pelvis. The study of hygiene also makes it possible to destroy pathogenic germs and to keep them away from the body. As an example may be mentioned that the instillation into the eyes of the new-born of a solution of silver nitrate will destroy the germs of gonorrhœa, if such be present, thereby saving thousands of children from almost certain blindness. No less important is the sterilisation of infective material, such as the expectoration of consumptives, and the stools of patients suffering from cholera, typhoid fever, or other contagious diseases.

Bacteria require moisture and darkness for their propagation; they rarely survive when dried, or exposed to light. The sewering of cities dries the soil, and is therefore of great hygienic value. Small amounts of bacteria are best killed by heat or chemicals (disinfection of clothes, laundry, rooms).

Attempts to diminish the body's susceptibility to germ-diseases by vegetable diet, sun-baths, and porous clothing are fruitful of only slight results. Uncivilised tribes are exposed all day to the sun and live almost exclusively

on plants and their valuable salts, so that they may be regarded as well hardened; yet their susceptibility to certain infectious diseases (such as smallpox, plague, cholera, and syphilis) is very pronounced. This may be explained as being due to the circumstance that these tribes are not yet saturated with these infections. It is a well-known fact that a race becomes less susceptible to a disease after it has passed through several epidemics of that disease. The reason for this is a twofold one: the more susceptible individuals succumb; and those that recover become immune from further attacks of the same disease. This immunity is thought to be transmitted to the offspring. One attack of smallpox will almost invariably render an individual immune from this disease for the rest of his life. If a pregnant woman suffers an attack of smallpox, the child usually passes through this disease and is born immune from further attacks.

Vaccination is founded upon the observation that recovery from a certain disease protects against a new infection for a considerable length of time. It is practised especially against smallpox, diphtheria, and hydrophobia. Vaccination with cowpox (obtained by passing the smallpox germ through a cow, thus rendering it less virulent) will protect the human being against smallpox for a long period.

The treatment of diphtheria by antitoxin serum, according to Behring's method, is founded on a different principle. It depends upon the fact that the blood of an animal (usually the horse) which has been treated continuously with diphtheria bacilli eventually acquires the property of killing these bacteria and of neutralising the poison formed by them.

Injection of this serum into man protects the healthy against infection with diphtheria, and assists those already infected in combating the germs and in neutralising the poison already formed. See IMMUNITY.

IV.—THE COURSE OF DISEASE

Some diseases terminate, either successfully or fatally, in a few days; these are spoken of as *acute* diseases. Others, which run a course of several weeks, are called *sub-acute*; and still others, which require months years, or even decades, are termed *chronic* diseases. A chronic disease may remain inactive for some time, so as to simulate a cure. This may frequently be observed in locomotor ataxia, epilepsy, consumption, gall-stones, etc. During such periods of inactivity quacks often claim to have effected a cure in cases which physicians had previously pronounced incurable. Reappearance of a disease which has already run its course is called recurrence or relapse, and is common in relapsing fever, typhoid, ulcer of the stomach, varicose ulcer, cancer, etc.

No disease invariably runs the same course in different individuals. The varying virulence of bacteria alone will account for mild and severe

cases, and for all possible intermediate forms. The regular course of a disease may be modified by one or more new infections. Such "mixed" infections are not uncommon. Tuberculous lungs, for example, frequently harbour the germs of suppuration which are responsible for the high fever and the excessive cough of consumptives. Further, the susceptibility of

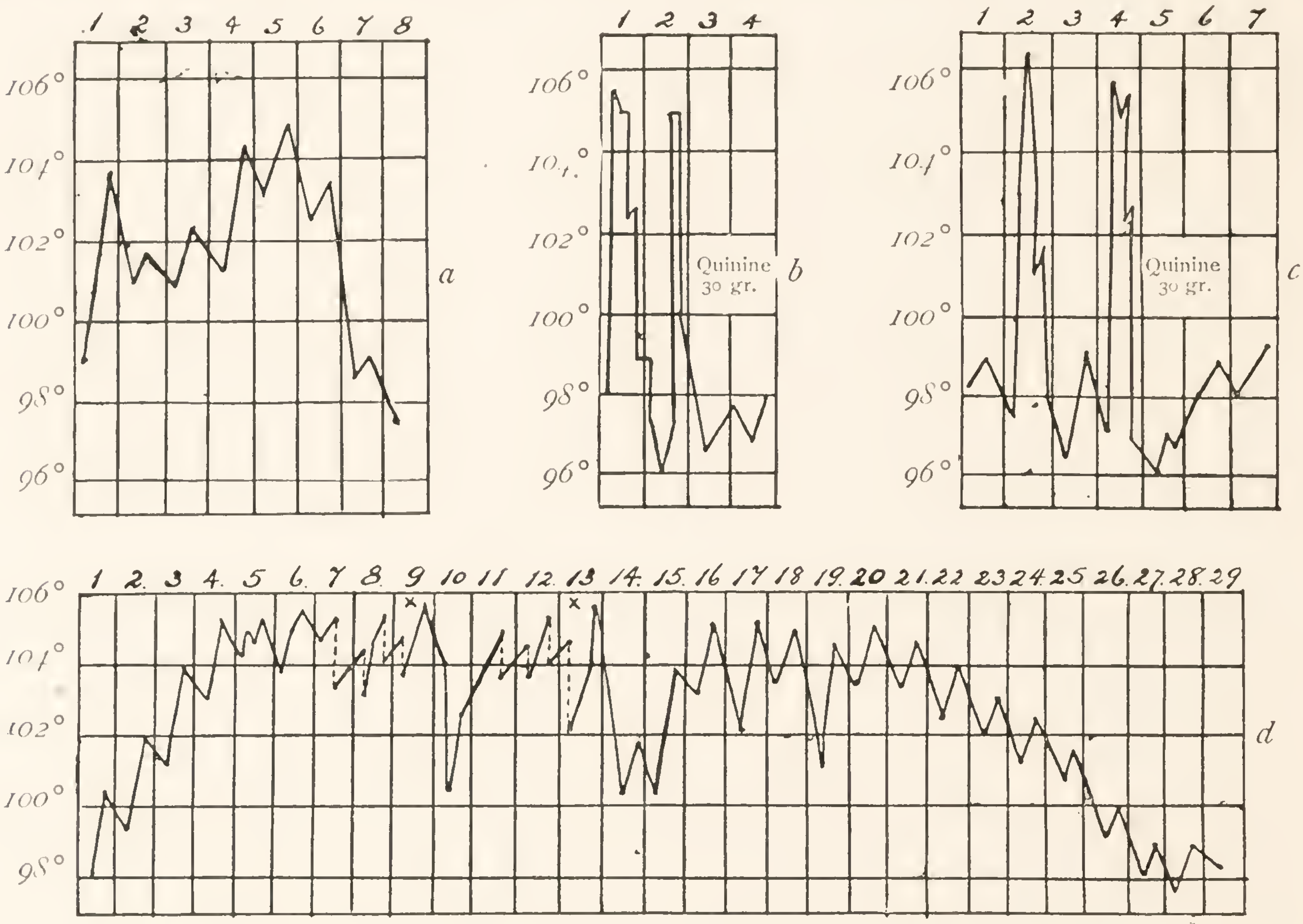


Fig. 67. Fever charts showing temperature-curves for (*a*) measles, (*b*, *c*) malaria, and (*d*) typhoid fever.

certain organs may considerably aggravate an infection. Scarlet fever, for instance, is often accompanied by suppuration of the ear and inflammation of the kidneys. Predisposed women may become temporarily insane after childbirth.

Most of the different diseases, however, run a regular (typical) course. In the so-called infectious diseases, there is first a period of incubation, which follows directly upon the infection, and during which the patient feels perfectly well. This period varies in duration for the different diseases; it may last from three to eight weeks in hydrophobia; from ten to fourteen days in smallpox; from thirteen to seventeen days in chicken-pox; from two to seven days in diphtheria; and from four to seven days in scarlet fever. Then follow the stages of eruption, of the acme of the disease, and of improvement. The course of the fever may be so regular that the temperature-curve alone will enable the physician to diagnose the disease.

In measles, for example, the renewed rise of temperature with the appearance of the eruption on the fourth day is characteristic (see Fig. 67, *a*). The fever-curve with different types of malaria is likewise very typical.

The note "Quinine 30 gr." seen upon the charts (Fig. 67, *b*, *c*) shows that the reappearance of the fever on the third, fourth, and sixth days of the disease was prevented by giving thirty grains of quinine. The temperature-curve of typhoid fever shows (1) the development of the disease (gradual ascent of curve up to the sixth day); (2) the acme of the disease (steady height of curve from the sixth day to the twentieth); and (3) stage of improvement (gradual descent of curve). The mark **X** in the chart (Fig. 67, *d*) shows that on the ninth and thirteenth days of the disease the fever was temporarily depressed by quinine.

V.—THE TERMINATION OF DISEASE

Most diseases are self-limited, and the body returns to its former normal condition. In other cases bodily defects remain. These may be of no importance, as in the case of scars after small ulcers; or they may interfere considerably with the functions of organs. The scars resulting from severe burns may cripple the affected arm or leg completely. The new growths which take place on the valves of the heart after inflammation of the heart-membrane (*endocarditis*) may modify the openings of the valves and lead to grave disturbances of circulation. This may be compensated for by increased growth of the heart-muscle, which will intensify the motor power propelling the blood. Such a heart, however, cannot act normally, and its owner must carefully avoid exertion. An ulcer at the opening between the stomach and the small intestine (the *pylorus*) may heal with a scar which will narrow the pylorus. This brings about stagnation of the contents of the stomach, and consequent dilatation of that organ. Such contraction of the pylorus can be remedied only by an operation.

A number of diseases are incurable, although they may remain stationary, without causing death. An individual may attain a ripe old age in spite of repeated epileptic attacks, or of permanent mental derangement, or of chronic catarrh of the stomach; and he may die of another disease, an accident, or senility. Most incurable diseases are, however, progressive; and sooner or later they terminate fatally.

Death invariably sets in when circulation and respiration cease. It may be due to hæmorrhages from the stomach or from the lungs; or to suffocation in pneumonia, when obstruction of the lungs does not leave enough space for breathing; or it may result from obstruction of the brain-centres which govern respiration and circulation (caused, for instance, by a blow on the head; or resulting from cerebral hæmorrhage due to the rupture of a vessel). Death may follow also upon intoxication with chemical or bacterial poisons (as in many contagious diseases), or after long-continued illness or insufficient nourishment.

A few remarks concerning cures by Nature and by artificial means may aptly conclude this chapter. The body's tendency toward cure depends upon the fact that it resists all attempts made to injure it. If a foreign body, such as a piece of ivory, be introduced into flesh or bone, it will eventually be cast off by a process of suppuration. The same thing happens to bacteria which enter the body. They are either killed by the body, and removed through the perspiration, the urine, or through pus ; or else they become encapsulated and remain harmless as long as shut off from the rest of the body.

Fig. 68. Broken bone healed without shortening.

Fig. 69. Broken bone healed crookedly with shortening.

The human body has the property of removing poisons through the natural excretory channels, or of rendering them harmless by manufacturing anti-poisons. It may also replace losses of tissue by new growth, the closing of wounds by the formation of new skin being a well-known example. In fractures of bones, the severed ends are united by the formation of new bone (see Fig. 68). Wounds of the soft parts heal by a process of granulation, new tissue (so-called granulation-tissue) eventually filling the cavity of the wound ; this form of healing leaves a shrivelled scar. It must not be forgotten, however, that spontaneous healing has its limitations, and that not every defect can be remedied by Nature alone. Even the contraction of scars may give rise to serious disturbances, by narrowing important canals of the body. In such cases the physician's help is required. By cutting out the shrunken scar and sewing the raw wound-edges together, perfect healing will generally take place, without the formation of granulation-tissue, and without contraction of the edges. The application of splints is necessary to make the two ends of a broken bone unite in a straight line (see Fig. 69). Without proper surgical treatment the limb may become useless. If a piece of the intestines is strangulated in the sac of a hernia, its walls will become gangrenous, the stools will discharge into the abdominal cavity, and the patient will die. By bloodless reduction, or by a surgical operation, the constriction may be relieved and the life of the patient saved. While the body cannot form an antidote for every poison, it may be assisted by the direct injection of the needed

antidote. Atropine is successfully used in cases of mushroom poisoning, since this drug is an antidote for muscarine, the active principle of poisonous mushrooms.

The removal of injurious substances cannot always be carried out by the body alone. If a collection of pus be located in the deeper parts of the body, the overlying tissues may be too firm to permit a spontaneous discharge. Unless these tissues are severed with a knife so as to permit free drainage, the patient may die of septic fever. A cancer-nodule is never cast off spontaneously; and the patient will surely die of cancer unless the tumour is excised at once, or destroyed with strong caustics. Without assistance the body can rarely deal successfully with the causes of malaria and of syphilis. The former may, however, be destroyed by the administration of quinine, and the latter by mercury, and thus many lives may be saved. The principle of this treatment depends upon the fact that these germs are by far more susceptible to certain poisons than are the body cells, and that they may therefore be destroyed without injury to the system. A tapeworm may be harboured in the body for twenty or thirty years, but certain remedies will expel it at once.

Great advances have been recorded also in dentistry, and no sane person would think of letting Nature cure his carious teeth. It is therefore a mistake to say: "What Nature cannot heal, it is vain for a physician to attempt to cure." Proper treatment, however, calls for a thorough knowledge of the properties of the human body, as well as of the peculiarities of the different diseases.

DIAGNOSIS AND TREATMENT OF DISEASE

I.—DIAGNOSIS OF DISEASE

It is sometimes very easy to diagnose a disease, as, for instance, when the false membranes characteristic of diphtheria are found upon the tonsils of a child who complains of pain on swallowing. But not all diseases may be so readily diagnosed. An individual may feel perfectly well, and yet a casual examination may reveal a disease which will soon prove fatal. A young man, for instance, desiring to have his life insured, submits to a medical examination, when it appears from the condition of his urine that he is suffering from diabetes. Not being convinced of the serious character of his illness, he does not adhere to the diet prescribed by his physician; and some day he may suffer an attack of unconsciousness from which he cannot recover. Another young man wishes to enter the Army, and is greatly surprised on being told that he has heart disease. He had no idea that anything was the matter with his heart, because his former occupation, that of a tailor, never required any special exertion of that organ. If accepted for military service he might easily have succumbed after a fatiguing march.

The state of an individual's health can never be determined off-hand; a careful physical examination is always necessary to settle this question. If life insurance companies, railways, military organisations, etc., were to have their physical examinations conducted by quacks, who claim to detect disease by simple methods, they would soon suffer by it.

It has been shown in the preceding chapter that diseases cause disturbances in one or more organs, and that most maladies are local. An accurate examination of all organs is therefore necessary before an opinion can be given. This examination includes the physical and the chemical constitution, as well as the functions of the organs. The physician's first care is to note the history of the patient's illness, which may be so characteristic that a diagnosis can be made from it alone. In certain hereditary diseases the family history is also of importance; and no material facts should, therefore, be withheld from the physician, who—in contradistinction to the quack—is obliged by law to treat confidentially everything referring to his patients.

The physical examination proceeds as follows. At first the general condition of the body, the body temperature, the amount of fat, and the

development of the muscles and bones are noted. When this is done, a more careful examination is made of the organs which are supposed to be the seat of the disease. Their general appearance, size, form, and consistency are detected by inspection and feeling. With the aid of the more recent methods of examination the physician can inspect the interior of the eye, the ear as far as the drum-membrane, the nose, nasopharynx, pharynx and

FIG. 70. X-ray picture showing piece of broken needle in hand

larynx, the trachea and its larger branches, and the mouth, œsophagus, stomach, abdominal cavity (by means of laparotomy), rectum, vagina, urethra, and bladder. By percussion and auscultation he may get a good idea as to the condition of the lungs, the heart, and the other organs. On listening to the lungs, heart, and blood-vessels, certain sounds are heard which change with disease (normal and pathological heart-murmurs). Whether or not an organ contains air can be determined by percussion, since solid organs (such as lungs in pneumonia) give a different sound from those containing air (as normal lungs). This may be easily demonstrated by thumping on an empty and on a full barrel. Air-containing organs (such as lungs and intestines) may thus be distinguished from the solid ones

adjoining them (heart, liver, full bladder, tumours, etc.); and in this way their varying size in health and in disease may be determined.

Chemical and microscopical examination of the various excretions (such as urine, gastric juice, fæces, etc.) assists in diagnosing diseases. If, for instance, tubercle bacilli are detected in the expectorated sputum, a definite diagnosis of tuberculosis can be made. Examination with the Roentgen rays is an invaluable aid. It enables metallic foreign bodies to be seen, discloses injuries and changes in the bones (see Fig. 70, and Plate XV.), and renders it easy to observe enlargement of the heart and of the aorta. There are still other delicate methods of distinguishing certain diseases from closely related ones. If the blood of a patient supposed to suffer from typhoid be brought in contact with a culture of typhoid germs, the latter will become immovable and clump together if the patient really suffers from that disease. If this does not occur, the patient, as a rule, suffers from some other illness.

Testing the function of the various organs is of great importance. It is applied especially to the brain and spinal cord, since these two organs are not readily accessible to examination. The physician often tests functions which are hardly thought of by the layman, and which the latter may consider of no importance (sense of warmth, cold, touch, and pain; co-ordinated movements of the muscles; and reflex movements, such as contraction of the pupils on illumination). The examination of the nervous system is so delicate that the physician can tell the exact location in the brain and spinal cord of tumours no larger than a cherry, and may thus be able to remove them by operation.

The methods employed by quacks, on the other hand, are scant and often ridiculous. They frequently claim to detect a disease by inspecting the urine, by noting the expression of the face, or the condition of the hair, or even by examining wedding-rings, etc. Very often even the better classes get into the hands of such charlatans. It is evident that an inspection of the urine will only tell whether or not the urine is clear; from the facial expression one can merely form an idea as to the emotional state of the patient; while the hair will enable a diagnosis only if it is diseased, which may happen once in 100,000 times. The wedding-ring will prove that the patient is married, and, if it is worn, that she has been married for some time. The ring will no more disclose the patient's disease than it will tell how much money she has in her pocket. It seems hardly necessary to mention these things; yet the claims of quacks are so loud that even the most intelligent are often persuaded against their will to put faith in them.

Many will be greatly impressed if the physician or the quack makes a so-called "snapshot diagnosis." This, however, is not always difficult. By merely looking at a tall, pale individual with narrow chest, frequent

respiration, and cough, it can easily be told off-hand that he has consumption, that he expectorates mucus, has difficulty in ascending stairs, rarely has much appetite, etc. There are many other diseases which may be diagnosed as readily; for instance, exophthalmic goitre, myxœdema, Addison's disease, advanced cirrhosis of the liver, etc.

It is needless to say that a respectable physician will not resort to such methods, since he knows that much more than the actual diagnosis is necessary for the treatment of his patients. In addition to the name of the disease, its cause, character, and location must be investigated. He must determine how far the changes in the organs have advanced, and if the remaining organs are in a normal condition. The patient's occupation, his means, and many other things have to be considered before a proper course of treatment can be decided upon.

II.—THE TREATMENT OF DISEASE

The treatment varies considerably with the different diseases; but in most cases an attempt is first made to remove the cause of the disease. This may sometimes be successfully accomplished. Poison accidentally swallowed can be washed out by means of the stomach-tube; contaminated food can be got rid of by a laxative; a cancer nodule may be excised; a tapeworm expelled, etc.

If the cause of disease cannot be removed, it may sometimes be destroyed within the body. In carbolic acid poisoning, sulphate of soda is given, since it combines with the carbolic acid to form a harmless compound. The parasite which causes scabies may be killed directly in the skin. Sometimes even bacteria may be killed without harming the body-cells. Thus, the cause of malaria succumbs to quinine; salicylic acid is fatal to the cause of acute articular rheumatism; and mercury destroys the germ of syphilis.

Where the disease-producing bacteria cannot be killed, it may still be possible to diminish their number or to modify their virulence. By the opening of an abscess many of the pus-producing bacteria are removed, so that suppuration will not progress any further. Bacteria present in wounds may be removed or rendered harmless by irrigating the wound with antiseptic solutions. The poison formed by diphtheria is neutralised within the body by injecting antitoxin. A certain quantity of injected antitoxin frees the body from a definite amount of poison.

When no other remedy is at hand, an attempt is made to remove the poison by excreting it with the tissue-juices. To accomplish this, the excretions of sweat, urine, and fæces are increased. If the amount of urine be diminished, as in insidious Bright's disease, some diuretic is given to increase this amount, since otherwise deleterious substances (such as urea)

which are normally removed by the kidneys would be retained in the body. Remedies causing active perspiration and increased action of the bowels were formerly very much in favour, but if this mode of treatment is too frequently resorted to, more harm than good will be accomplished.

To support the body in its battle with disease is another important duty of the physician. In many cases the body-cells alone will bring about a cure, and in various instances Nature may be materially assisted. The physician thus endeavours to diminish the work of the diseased organ, as by advising bodily rest in heart disease, and a special diet in nephritis. The activity of an organ may sometimes be diminished by the administration of drugs ; opium, for example, is given to quiet the intestines.

In certain relaxed conditions the organs must be strengthened : weak muscles, by gymnastics and massage ; a weak heart, by careful, active movements ; a strained nervous system, by baths and electricity. Certain drugs are often very valuable in toning up some organs. Thus, a decoction of foxglove (*digitalis*) is more serviceable than anything else in overcoming stagnation of the blood due to cardiac weakness.

The diet is a very important factor in treating disease. Thus, in typhoid fever, where the intestines are riddled with ulcers, solid food is actually dangerous ; while, on the other hand, substantial food is essential to cure tuberculosis. Certain diseases, as diabetes, gout, obesity, etc., may be cured by dietary treatment alone. A " dry diet " was formerly prescribed by some fanatics for all ills ; but at present it is considered of benefit only in the treatment of well-nourished patients suffering from dropsy, in order to rid the system of some of the accumulated fluid.

In some cases drugs may be introduced into the system to replace substances which the body can no longer form. As an example may be mentioned the administration of pepsine and muriatic acid in diseases marked by deficient function of the gastric glands. In myxœdema, a peculiar disease marked by thickening of the skin, the secretion of the thyroid gland is wanting. This disease can be treated successfully only by feeding the patient continuously with the thyroid glands of animals. See Thyroid Gland, Diseases of.

It is necessary in every case to take into consideration the patient's mental condition. One individual will require encouragement; another, warning. For one, complete rest is necessary ; for another, diversion. In some diseases, such as melancholy and nervousness, the physician must constantly reassure the patient that his fears are unfounded.

Symptomatic treatment is resorted to in diseases where the actual cause cannot be removed. In such cases the physician directs his attention to the chief symptoms, endeavouring, for example, to reduce fever by baths and drugs, or to deplete blood in internal inflammations, by mustard-paper, leeches, or cupping. In incurable cases, the physician may only be able to

order proper nourishment and to diminish the patient's suffering. The last days of life should be made as comfortable as possible, so that death may be painless. This can be accomplished only by the aid of drugs. The symptomatic treatment has been unjustly ridiculed by those who claim to cure by "Nature." In incurable diseases the laws of humanity demand a relief from distressing symptoms; while in curable affections this form of treatment is often indirectly curative. Attacks of biliary colic run a much milder course, and gall-stones pass through the ducts more readily, if proper anodynes are given.

The water-cure itself constitutes a purely symptomatic form of treatment, tending only to increase or diminish the excretions or the circulation in some part of the body, to raise or lower the body temperature, or to stimulate or quiet the nerves. It is evident that this may be very good for some patients, but it constitutes only a very small part of the remedies at the disposal of the physician. Only a quack can laud a remedy as useful for a great many ailments; but he who claims to be able to cure all diseases is a still greater fraud. It is no more possible to do this than to construct a key that will fit all locks. It is often impossible to diagnose with certainty a beginning cancerous node in the lungs, or to remove it by operation or otherwise. It is likewise impossible to restore a perforated heart-valve to its normal condition.

The proper treatment of patients calls for a great deal of knowledge and tact on the part of the physician. He must have a thorough knowledge of the various diseases and remedies, and must also take the patient's means into consideration. The treatment of disease is an art which cannot be acquired without diligent study, and even then it is not everybody who can practise it well. A great variety of remedies may be applied in combating a disease. Thus, for anæmia the physician may prescribe light-baths, drugs, or change of climate; or he may clean out the bowels, since their fermenting contents deteriorate the blood. Not every patient with the same ailment will tolerate the same remedy equally well. The physician's experience and instinct must choose what is best. The layman should never suggest a certain line of treatment, particularly since the same symptoms may signify a variety of different diseases. Oppression in the stomach and belching of gas after eating may be signs of nervousness, of catarrh of the stomach, or of an ulcer or cancer of the stomach. In the last-named case an immediate operation is necessary; in the first-mentioned, a simple remedy like bicarbonate of soda may remove all the symptoms. In such cases advice by one who is not a physician may delay the proper treatment.

THE STANDARD PHYSICIAN

A—L

THE STANDARD PHYSICIAN

A

ABDOMEN.—See INTRODUCTORY CHAPTERS.

ABDOMINAL PAINS.—Pains which originate in the stomach, intestine, peritoneum, in the liver, spleen, uterus, or in the kidneys and in the genital organs situated in the abdominal cavity. They may occur either temporarily, in attacks (see COLIC), or they may exist more or less permanently. They are caused by quite varying affections of the above-named organs: Inflammations, suppurations, adhesions, ulcers, tumours, etc. The pains are sometimes restricted to only one, or several places, at other times they extend over the entire abdomen. The direction in which the pains may radiate is of importance in recognising the causative disease, or in determining its significance. The intensity of abdominal pains, even in one and the same disease and in the same patient, is subject to great variations. At times such pains are very slight, while at other times, as a result of impacted gall-stones or kidney-stones, they may be so severe as to cause even robust men to faint. The pains are brought about by marked irritation of the nerves of the affected organs.

The best remedy for abdominal pains of any kind is hot compresses (moist or dry) which must be renewed as soon as they become lukewarm. Most suitable are linseed poultices and hot plates, or hot-water bags. A hot-water enema may relieve many a severe attack of colic, particularly if there has been persistent constipation. The physician is also able to combat very intense pains effectually by medicines which are given internally or injected under the skin. Every patient with severe abdominal pains who is not relieved easily by hot applications or hot enemas needs professional advice.

ABORTION.—The expulsion from the uterus of the fœtus before it is viable. Abortion may be brought about accidentally or wilfully. The wilful act, no matter at what time of pregnancy it is perpetrated, is severely punished by the laws of most civilised countries. In the German statutes, for instance, a pregnant woman who purposely induces abortion or kills the fœtus in the uterus is liable to imprisonment for a period not exceeding five years. The same punishment applies to those who provide her with the means of doing this, or in any way assist her in the act. Similar laws are on

the statute books of Great Britain, where the causing of an abortion is a very serious offence which may amount to murder. The means referred to include certain internal medicaments and instrumental procedures—intra-uterine injections intended to rupture the membranes or separate the embryo from its attachments. Mechanical means are certain to bring on labour pains and the expulsion of the ovum ; but the action of the popular, internal remedies is very uncertain and often harmful. Their use may lead to severe and sometimes fatal poisoning or to permanent injury to health. The mechanical methods without proper precautions in regard to absolute antisepsis may cause general blood-poisoning and, if the instruments are unskilfully used, a rupture of the uterus. Both of these may lead to a fatal issue.

Severe illness of various kinds in pregnancy may require the induction of abortion in order that the woman's life be saved. The physician should, however, exercise this right only after due consultation with a colleague. Many abortions, called also miscarriages, are due to accidental causes.

ABSINTHISM.—A chronic form of alcoholism, to which is superadded the effects of the volatile oil of absinthe (*Artemisia absinthium*) and other volatile oils, particularly oil of anise, which is the predominant flavour of the drink. The effect on the brain of many of the volatile oils, particularly that of absinthe, is to cause mental excitement ; and when used in conjunction with alcoholic drinks a form of maniacal excitation may be brought about in some. Convulsive seizures of an epileptiform nature are also known to occur in chronic absinthe drinkers.

ABSCESS.—A local collection of pus, consisting of broken-down blood-cells, some disintegrated tissue, and bacteria. An abscess is usually localised, or kept within narrow bounds by the effort of Nature to wall off other parts of the body from infection. Abscesses in the skin, usually due to an INFECTION which travels down in a hair follicle, or a sweat gland, are termed BOILS or CARBUNCLES. Abscesses in the fingers, usually pointing beneath the nails, are termed *felons*. Abscesses are frequently found in the liver, from amœbic infection, or typhoid fever ; and also in the abdomen as a result of an inflamed or gangrenous appendix. See APPENDICITIS ; PERITONITIS. They are frequently found in bones, and are here often called cold abscesses, because they are chronic in their course. Such cold abscesses are usually due to the bacillus of tuberculosis. Abscesses of the brain frequently result from infection through a running ear, or an infected mastoid, occasionally after an accident.

Abscesses may break into the open air (as in boils, felons, etc.), in which case they frequently heal spontaneously ; or they may break within the body, and are then dangerous, causing septicæmia or pyæmia. See BOIL ; CARBUNCLE ; PYÆMIA and SEPTICÆMIA.

ACNE.—A disease of the fat-follicles of the skin and often of the adjacent hair-follicles. Simple acne, or pimple, "indurated acne," a more deep-seated affection, "rose acne," and "rum blossoms" are types of this disease. See SKIN, CARE OF.

ACONITE (Lat. *Aconitum*).—A genus of plants belonging to the Buttercup family (*Ranunculaceæ*) which are highly poisonous and have been used in medicine for many centuries. *Aconitum napellus* is the plant that yields the commonly used medicine. The action of aconite is due to an alkaloid (*aconitin*) which is one of the most powerful poisons known. Aconite causes the heart to beat more slowly from depression of the heart muscle and from stimulation of the inhibitory apparatus. It also dilates the blood-vessels, causes sweating, and diminishes the sensibility of the nerves of touch and pain. In poisonous doses (more than 5 drops of the tincture may cause poisoning) the symptoms are nausea, vomiting, cold and clammy skin, great prostration, and slow, irregular pulse. Artificial respiration, hot coffee, and hot bottles are useful until a physician arrives. Aconite is a very powerful drug, and should be prescribed by none but physicians.

ACTINOMYCOSIS.—A disease caused by a ray-like mould (*Actinomyces bovis*) which grows upon ears of corn, and grains. It occurs oftener in animals, particularly cows, rarely in men. The mould finds access to the human body through injuries or wounds of the mucous membranes of the mouth or pharynx, or through carious teeth, or by way of the gastro-intestinal tract. The disease develops generally in the jaw-bone, which swells and becomes partially destroyed; also in the cheeks, the tongue, the throat and the neck, spreading to the vertebral column and to the thorax. Firm swellings appear, which soften, break through, and discharge thin pus, containing yellow-coloured particles in which the fungus characteristic of the disease may be detected by the microscope. The course of the disease is either short, accompanied by fever, or it may last for months and years, and lead to degeneration of the organs and to death. Certain forms resemble chronic pulmonary tuberculosis. Milder cases may be cured if taken in time. Both mild and severe cases are sometimes cured by operative interference. For the prevention of this condition, some stress may be laid on the senseless habit of chewing grass.

ADDER-BITE.—See SNAKE-BITE.

ADDISON'S DISEASE.—A morbid condition associated with inflammation or tumour of the suprarenal bodies, thus disturbing their function, and characterised by the appearance of a mottled or uniformly distributed brownish discoloration of the skin, especially in those parts of the body which are exposed to the light (see Plate XIV., Fig. 3.). The staining may extend into the mucous membrane of the mouth, and may also be present on the soles of the feet, around the waist in women and in other localities where the skin is normally somewhat darker than usual. During its early

stage the disease is marked also by fatigue, weakness, loss of appetite, vomiting, and diarrhœa or constipation. Later on there are observed additional symptoms, as headache, insomnia, mental weakness, emaciation, and periods of unconsciousness. The disease usually persists for many years. The treatment consists of measures directed to the strengthening of the system and the alleviation of distressing symptoms as they appear. The administration of suprarenal extract in tablet form has been attended by good results. Cathartics must be given with caution, as in certain cases they may make the disease worse.

ADIPOSIS DOLOROSA.—A disease, chiefly of women, attended with marked obesity and neuralgic-like pains, usually localised over fatty swellings in the body. It has been at times associated with alteration in the thyroid gland, and internal administration of the thyroid secretion has proved of service in some instances.

ADOLESCENCE.—See Growth.

AGARICUS.—The name of a large group of fungi generally characterised by an umbrella-like hood and radiating gills beneath. At one time the name Agaricus covered the whole group, but is now split up into a number of genera, or subgenera, differentiated largely by the colour of the spores and the shape and attachment of the gills. The ordinary edible mushroom of the fields is the *Agaricus* (*Psalliota*) *campestris*; the poison cup is the *Agaricus* (*Amanita*) *phalloides*; and the fly mushroom is the *Agaricus* (*Amanita*) *muscaria*. At least a thousand different species are known, many of them being edible and a few poisonous. See Plate XX.; also article Mushrooms.

AGGLUTINATION.—See Widal Test.

AGGLUTININS.—See Immunity.

AGORAPHOBIA.—See Fear; Obsessions.

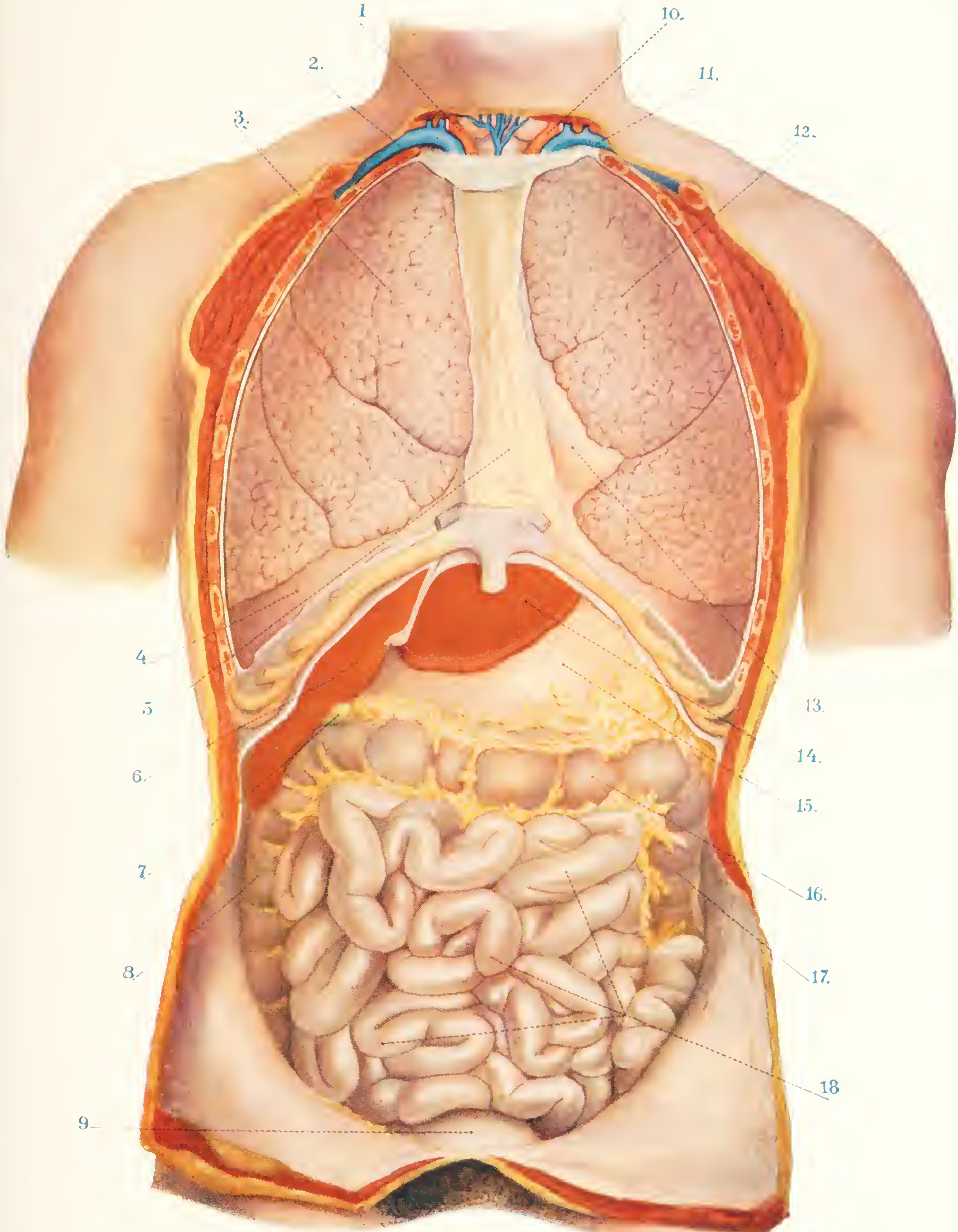
AGUE.—See Malaria.

AIR-BATH.—A bath in which the patient exposes his bared body to the (agitated) air, at the same time taking vigorous exercise. Every sun-bath is, naturally, also an air-bath; but in the true acceptance of the word, the above-mentioned form of bath is that generally implied by the term "air-bath." For the purpose of administering these air-baths, modern sanatoria are often supplied with these so-called air-bath parks. But, unfortunately, even procedures which are hygienically of value are often exaggerated. Careful persons begin with air-baths in the room, with the windows open, taking at the same time gymnastic exercises. Exercise is absolutely necessary, to stimulate the circulation of the blood; if this is not done, the bather exposes himself. To begin the treatment, a warm, sunny day should be selected. After being gradually accustomed to air-baths, they may be taken at lower and lower temperatures, the length of time of exposure depending in large measure on the condition of the air.

PLATE III.—THE CHEST AND ABDOMEN

(After removal of skin and muscles)

1. Right subclavian artery	10. Left subclavian artery
2. Right subclavian vein	11. Left subclavian vein
3. Right lung	12. Left lung
4. Diaphragm (covered by pleura)	13. Heart (covered by pleura)
5. Space between right and left pleura	14. Left lobe of liver
6. Right lobe of liver	15. Stomach
7. Gall-bladder	16. Transverse colon
8. Ascending colon	17. Descending colon
9. Bladder	18. Small intestines (jejunum and ileum)


1
2.
3.
4.
5
6.
7.
8.
9
10.
11.
12.
13.
14.
15.
16.
17.
18

Air-baths stimulate the skin, produce an agreeable feeling of warmth, and refresh the body and nervous system. They are an excellent measure for arousing hypochondriacal persons to greater self-confidence. Air-baths have had more vogue in Germany than in Great Britain; indeed, there seems to be little need for them in the latter country in view of the excellent outdoor bathing facilities enjoyed by nearly all.


FIG. 71. Albino.

ALBINISM.—An abnormal deficiency of pigment or colouring matter, "albinos" being the term applied to persons thus afflicted. The symptom is a lack of the pigment normally present in the skin, the hair, and in certain membranes of the eye. As a result, the pupil and the iris are reddish, and the skin of the body a pale white, only in places presenting a pink tint, due to the underlying blood-vessels; the hair is a yellowish-white, thin, and resembles flax (see Fig. 71). Apart from certain visual disturbances extreme sensitiveness to light, etc.), no other symptoms of any consequence have been observed. The condition is congenital, and continues unchanged through life. There is no known cause for the trouble. Heredity is not, apparently, a factor. Among the white races, albinism is more infrequent than among the negroes. It has been thought that the condition may result from an arrested development of the pigmentary layer in the embryo.

Aside from a condition of general lack of pigment, there are cases marked by localised absence of colouring matter, which may be manifested at birth, or developed later in life. In these the skin may show white patches of varying size and shape, and whatever hair grows on them is also of a whitish colour. Where this condition comes on later in life, the white patches are surrounded by a more deeply pigmented area. The spots may enlarge and run together to such an extent that the skin closely resembles that of an albino. There are no disease symptoms connected with this complaint. White patches of varying sizes may also appear in persons afflicted with syphilis or leprosy. Albinism of the eye refers to the congenital absence of pigment in the iris and choroid coat. As the former is transparent, it appears pink owing to the underlying blood-vessels. A red shimmer which is also seen in the pupil is due in part to the vessels in the choroid, and also to the light which can penetrate through the sclerotic coat in these eyes. These conditions are distinctly shown in white rabbits. Albinism is always

accompanied by disturbances of vision; the afflicted persons being more or less near-sighted, and it will be observed that the eyeball is constantly in motion. Vision is poor in sunlight, owing to the glare, but improves at night.

ALBUMINURIA.—A condition marked by the presence of albumin in the urine. Albumin may be excreted by the kidneys in the urine either in a dissolved or an undissolved form. That dissolved in the urine is not visible, and can only be demonstrated by chemical tests; the other is present in the form of various coagulated products, which may be recognised by the aid of the microscope, as casts of the renal tubules, cellular constituents of these organs, etc. Albumin in the urine may be present in various percentages in diseases of the kidneys, severe constitutional disturbances, poisoning, acute febrile diseases, affections of the heart, lungs, and blood, and even in healthy persons after bodily exertion, forced marches, or very cold baths. Albuminuria must, therefore, be looked upon as a symptom of varying import, which in many cases may be without any significance. It only becomes of moment when it is a permanent condition or is combined with the throwing off of kidney cells or of casts of the renal tubules. See KIDNEY, DISEASES OF.

ALCOHOL, or **SPIRITS OF WINE (called also ETHYL ALCOHOL, to distinguish it from other varieties of alcohol).**—A colourless, inflammable fluid with a burning taste and manifesting great resistance to cold. Temperatures which render mercury solid do not freeze alcohol. It is produced by fermentation from sugar solutions, the sugar being converted into alcohol and carbonic acid. It is also commonly made from potatoes and grain, such as barley, rye, corn, and rice. These plants contain starch, which, under the influence of certain fermentative processes known as malting or mashing, is split up into sugar and other substances. The addition of water induces fermentation, which results in the production of alcohol, such as that contained in beer or whisky. In the latter the percentage of alcohol is increased by the process of distillation.

There are various strengths of alcoholic fluids. Absolute alcohol is entirely free from water, and the ordinary Cologne spirit is 90 per cent., or even 95–96 per cent. alcohol. Next in strength comes rum, which is largely made from sugar-cane, and which may contain as high as 70 per cent. of alcohol; arak, made from rice or palm wine, with 50 per cent.; and French cognac, distilled from wine, which contains almost as much. The ordinary whiskies contain from 40–50 per cent. alcohol, while the German whisky, "branntwein," varies between 30 and 40 per cent. In the cheapest as well as in the most expensive whiskies, there are present, in addition, certain amounts of amyl, propyl, and other alcohols, known collectively by the name of fusel oil, which are highly poisonous. Wines and beers, which are not subjected to distillation, contain much smaller amounts of alcohol: Bohemian beer, 3–4 per cent.; Munich beer, 3–8 per cent.; porter, 5–10 per cent.; white wine, 5–12 per cent.; French red wine, 9–14 per cent.; southern wines,

10–17 per cent. ; champagne, 9–20 per cent. A natural wine (as sherry) should not contain more than 17 per cent. of alcohol. If more than this is found, it has been added secondarily. The ordinary cordials contain about 40–50 per cent. alcohol in syrup and volatile oils.

ALCOHOLISM.—Alcoholic beverages have been consumed from time immemorial. Tacitus reports their being used by our forefathers, the old Germanic tribes ; and the immoderation of the Middle Ages, especially in drinking, is well known. At all times man has sought and made use of substances which produced a narcotic effect, and by means of which sorrow and pain could be forgotten for even brief periods. Some peoples have obtained the desired result by means of alcohol, others by the use of other narcotics, notably opium by the Orientals, hashish by the natives of India, Egypt, etc. Some people drink wine, beer, or whisky to give them the sense of strength and power ; others to give them the feeling of warmth ; and still others claim that without alcohol there can be neither happiness nor sociability. All the claims seem plausible enough, but as an actual fact it may be stated that the apparently favourable effects of alcoholic indulgence are based on self-deception.

The ingestion of any alcoholic beverage is usually followed by a sensation of warmth. The face becomes flushed, speech follows readily, and there is developed a desire for action. Persons who are ordinarily quiet become loquacious, sometimes happy, sometimes quarrelsome. These results are attributed to the stimulating effects of the alcohol, but in reality the condition is quite complex and rarely a true stimulation. The blood-vessels in the skin dilate, because the nerves controlling their movements are partly paralysed. The blood, therefore, rushes to the surface and imparts a sensation of warmth. This spreading of blood on the surface, however, rapidly chills the body ; and, as a matter of fact, the interior of the body becomes colder rather than warmer. For this, as well as for other reasons, an intoxicated man is more likely to be frozen than one who is sober. The readiness of speech and flight of ideas also depend on the loss of restraint put on certain mental faculties. The bonds which counsel quiet, moderation, and good sense, are loosened, and the man deep in wine talks on, careless of the consequences which his ready speech may bring to himself or to others. In this respect there can be no doubt of the correctness of those well-known words " in vino veritas " (in wine there is truth), but the truth is not the expression of a free will, but merely the prattle of an irresponsible agent, an uncontrolled reflex machine. The great quantity of words spoken lowers their worth, and they are spoken without restraint. Such a person cannot follow a discussion nor put together the impressions received. He indulges in unnecessary and numerous gesticulations, often destroys the property of others, and desires to show his power by fighting. It is a mistake to attribute the latter result to any stimulating action of the alcohol ; on the contrary, it is

an evidence of loss of power to control, rather than any heightening of present faculties. In other cases, a benumbing of the sense of fatigue occurs, but the person apparently refreshed is later all the more exhausted.

If the indulgence in alcohol is continued, these paralytic conditions become more and more marked. The flushed face becomes pale, the eyes lustreless, the loquaciousness diminishes, the speech is indistinct, the general activity subsides. Unconsciousness more or less marked, accompanied by a cold, clammy condition of the skin and slow, noisy breathing, follows, and the intoxicated individual recovers from his exuberance of spirits and deeds in a resting-place often involuntarily selected. Not uncommonly, twitching and convulsions may result from alcoholic indulgence, and in some persons the narcotic state may come on without any preliminary period of excitement. Sudden death may ensue, and this has been observed where persons have taken large amounts of alcohol within a short time, as for a wager.

Repeated intoxication, or even the long-continued, apparently moderate indulgence in alcohol which in time exceeds certain limits, can gradually bring about an insidious poisoning of the system, which may be designated as chronic alcoholism. The stomach, being constantly exposed to the irritating effects of the alcohol, is the first organ to suffer, and it soon becomes the seat of a chronic catarrh. As a result of this, the appetite diminishes, nutrition is interfered with, and the entire system is thereby weakened. Morning vomiting is very common, the vomited material consisting largely of saliva swallowed during sleep, and of the excess of the mucus due to the catarrhal process. The liver becomes the seat of a slow degeneration ; it becomes fatty, or more often, new connective-tissue growth causes it to contract ; the kidneys do not act as well, and also become cirrhotic ; the heart enlarges, particularly in beer drinkers, on account of the increased amount of fluid which it is compelled to propel through the body ; it undergoes fatty degeneration, and gets gradually weaker. Men who drink a great deal without any apparent ill effects, often die very suddenly from cardiac weakness. In addition to the symptoms just enumerated, there are also developed various chronic catarrhs of the throat, larynx, and intestine ; and the arteries undergo hardening, which may go on to chalky hardening, or calcification. Of great moment is the involvement of the blood-vessels of the brain and nervous system. An ordinary trembling of the hands is a common symptom of over-indulgence. There may be sensory disturbances, such as pains in the arms or legs. These may gradually lead to inflammation of the nerves (neuritis), with loss of power to raise the wrist, or raise the toes ; or the brain itself may give out, and epilepsy and insanity develop.

In short, there is scarcely an organ of the body which is not influenced by alcohol sooner or later, and to some extent permanently damaged. In time the higher mental faculties become affected, and the individual becomes dull, awkward, careless, and thick-witted. Character and self-control are

lost, and the longer the habit has been present, the more difficult it becomes to overcome it. The drunkard's sense of his obligations to his family, to decency, and to custom, disappear, and soon he does not even realise the disgrace of his condition, having become wrecked both in mind and body. As the habit gradually diminishes the resisting powers of the organism, the alcoholic readily succumbs to diseases which the ordinary person withstands.

Delirium Tremens is a special type of acute poisoning which frequently develops during the course of chronic alcoholism. It is apt to come on after a particularly prolonged debauch, and is frequently set off, as it were, by a severe general disease, such as pneumonia, by injuries, or by great mental excitement. The patients are at first very nervous; they are in constant motion, tremble, have no appetite, cannot eat, or keep anything but liquids in the stomach, and they sleep very badly. During the day they may keep control, but as night comes on they frequently have hallucinations of sight and of hearing, these sights often being worse than the most dreadful of nightmares. In the severe cases the patients become wildly insane, maniacal; they may commit murder if unrestrained. Under proper treatment they frequently recover, but often die of extreme exhaustion.

A great deal can be said concerning the close relation of alcoholism to crime, but it will be sufficient to call attention here to the fact that a large percentage of the cases of murder, assault, resistance to the law, burglary, etc., can be attributed to the effects of this habit. Suicide, primarily or secondarily, may often be traced to alcoholic indulgence. Venereal diseases are frequently contracted by men during a debauch and transmitted to their wives. How much more dangerous than the ordinary deadly poisons, is, therefore, this substance, which not only affects the one who imbibes it, but also numerous innocent persons, destroys families, and even manifests its evil influence in succeeding generations. Sympathy must be extended to those unfortunates who are weak-minded or insane because their fathers were drunkards, and to those who are predisposed to nervous or mental diseases, to which they sooner or later must succumb. Disease, asylums, prisons, early death, and suicide can all be laid at the door of this enemy of mankind, which, in the guise of banishing pain, has falsely been called one of the benefactors of the human race. It would be possible to abandon many prisons and asylums if the continual poisoning of the nations by alcohol could be stopped.

The so-called periodic drinkers (dipsomaniacs) constitute a group by themselves. Sleeplessness, restlessness, headaches, etc., are the preliminary symptoms which stimulate a craving for alcoholic beverages, which they cannot resist and which must be satisfied at any cost. They care less for the kind or quality than they do for the quantity consumed. As soon as the attack is over, little or nothing is taken, until the craving again comes on,

which may be after an interval of week or months. Periodic alcoholic indulgence of this kind is usually a part of a periodically appearing mental disturbance, periodic mania or melancholia, or sometimes of acute exacerbations of nervous diseases, in which the patient employs the alcohol as a narcotic medium. Repeated or long-continued attacks may be followed by delirium, and occasionally they may end fatally.

The consumption of alcoholic beverages is steadily increasing, in spite of the undoubted harmful influences which they exert. The gigantic establishments for their production are the developments of the last few decades, and their growth depended on this fact. The consumption of beer particularly has markedly increased in all countries. Statistics are unnecessary here. They show, however, that the consumption of whisky has diminished during late years, whereas that of beer has largely increased. Many look upon this as a favourable sign, because whisky, being considered a stronger drink, is believed to be more unhealthy than the lighter beer. It must not be forgotten, however, that beer is consumed in much larger amounts than whisky, so that in the end the same quantities of alcohol are taken. As a whole, it is immaterial whether one favours beer or whisky. Whisky drinkers are more apt to develop delirium tremens and gastric and hepatic troubles than are beer drinkers, but the latter, aside from the effects due to the alcohol itself, endanger their heart and kidneys. The heart is affected by the increased quantity of fluid which it must pump, and the kidneys by the larger amounts of fluid which they are compelled to filter. It is impossible, therefore, to group alcoholic beverages on the score of their comparative harmlessness ; all of them act as poisons to the human organism, and are harmful.

In passing, attention should also be directed to the chronic intoxications due to the consumption of ether, eau de cologne, and absinthe. Ether drinking which is particularly prevalent in Ireland, brings on a condition of transitory intoxication without any after-effects. Many subject themselves to this intoxication several times daily ; and long-continued adherence to the habit affects both body and mind in a manner similar to that associated with chronic alcoholism. The use of eau-de-Cologne is attended by like effects, and the habit is particularly prevalent in Russia, England, and America. Chronic absinthe poisoning differs slightly from that caused by alcohol, the effects being due to the contained ethereal oils. The consumption of absinthe is limited mainly to France, and its continued use leads to severe nervous disturbances, extreme sensitiveness of the skin, pains, epileptic convulsions, and finally, in many, to insanity.

Until very recently, the drinking habit was looked upon as an incurable evil. Efforts were confined to exhortations which usually went unheeded. A great advance was made when it came to be realised that complete abstinence could alone free the individual from his desire for alcoholic beverages. The damage done to the various organs cannot be rectified, but

the drinker can be warned of further inroads on his health which are liable to occur. He again becomes the support of his family and a useful member of society. There is no medicine or secret remedy which, taken alone or with the alcoholic beverage, will cure the disease, and such claims are fraudulent.

The elementary principles for correcting the habit are about as follows. The individual must practise complete and total abstinence. In order to accomplish this, it is wise to commit him to a sanatorium specially devised for this purpose. When he is returned to his family, the latter must also lead an abstemious life. A change of occupation is advisable, especially if the person has been engaged in one which would lead or tempt him to indulgence. Furthermore, it is essential for him to associate with people who are also abstainers, and he should be encouraged to become a member of an organisation which has for its main object the redemption of drinkers.

These societies, a number of which exist in Great Britain, can be divided into those which counsel total abstinence, and those which permit moderate indulgence ; there are, besides, other organisations which combine both of these principles. This brings about a paradoxical situation in the practical treatment of the alcohol question ; whether the evil had better be combated by abstinence or by temperance. Our views are as follows : Any person who is made ill by alcohol, or is in any way harmed, must undoubtedly practise total abstinence. This also applies to anyone who cannot resist the temptation to drink more than is good for him, or who numbers among near or distant relatives any who are subjects of this habit. The danger lies in the fact that a slumbering predisposition to alcoholic over-indulgence may be present, which, under appropriate circumstances, may be stimulated to its full development. Every drinker claims to have been moderate at some time in the past ! An abstemious life should also be led by anyone who wishes to make life an example for those about him. It is only by complete denial that the tide may be stemmed. The example of moderate indulgence is of less value for the cause, because the conception of moderation may be interpreted to suit the individual caprice. He who believes that he cannot get along without alcoholic beverages should limit himself to small quantities, and then not fail to admit that he takes them, not for any beneficial properties supposed to be present in the alcohol, but merely to satisfy a taste as distinguished from a craving. But he must beware of drinking daily as a matter of custom, remembering that amounts which are ordinarily considered harmless have been shown by physicians to create a great deal of damage when taken day after day. This even applies to three or four glasses of beer per day. Many who believe themselves moderate cannot, as a matter of fact, be included under this designation.

If we finally try to persuade ourselves that alcohol is a necessary aid to

the encouragement of happiness and sociability, it will be found that the experiences of total abstainers prove the contrary. Mankind would be in a sad state if pleasure and enjoyment could not be generated without the excitation secured by the use of alcohol. It would require too much space to discuss in detail all the measures which have been proposed for the purpose of combating and preventing this habit. Legal restriction cannot be formulated until the public becomes converted to a different view regarding the value of alcohol. The necessary understanding and support of laws directed against alcoholism cannot be secured until this has been accomplished. Preparatory to this, it is now possible, however, to institute certain reform measures which will tend to bring about the ideal. Among them may be mentioned stricter requirements in granting licences to taverns, forbidding the sale of intoxicants before working hours, favouring inns which do not dispense alcoholic beverages, and the erection of a better class of dwellings for the working people. A great service can, moreover, be rendered by everyone who undertakes to break down the old mistaken notion that alcohol is gifted with wonder-working powers. As has been set forth, alcohol does not increase the strength or stimulate the body-heat ; nor does it favour digestion. It is a well-known fact that in training for athletic feats, the use of alcohol is strictly prohibited. North Pole explorers, and those engaged in whale fisheries, deny themselves any indulgence in alcohol. Abstinence is also required of those who reside in the tropics. In the cases of so-called frenzy of the tropics, over-indulgence in alcohol probably plays an important rôle.

In recommending alcohol as a nutrient or stimulating agent, it should not be forgotten that there is an abundance of such agents which are not harmful. Alcoholic beverages have only a limited application in medical treatment, and in most cases they can well be omitted. The custom of bringing along a bottle of strength-giving port, or some medicinal wine, when visiting the sick, should be given up and the patient regaled by other friendly attentions, such as flowers, fruits, etc. Especially harmful is the giving of wine to children. Up to the twentieth year, wine and beer should be strictly prohibited.

If by these means the taste for alcoholic beverages is overcome or at least diminished, the question naturally arises, " what shall be substituted for them ? " It is a well-known fact that an abstemious individual gradually loses the desire to drink, finally ingesting only an ordinary amount of fluid, sufficient to satisfy his natural thirst. Drinking does not come from increased thirst, but, on the contrary, the thirst may be said to be due to the drinking. In order to furnish the opponents of alcohol a variety in their beverages, a number of substitutes free from alcohol have been placed on the market, including non-alcoholic wine and beer, unfermented apple and grape juice, and a host of others. The abstainers are satisfied, but the

drinkers do not find them to their taste, because the alcohol has been omitted.

At present there is no efficient substitute, and the evil cannot be checked by this means. Education and the force of example are now the only agencies by which any favourable results can be attained. One should not bow down to the almost universal social custom, which prescribes the use of alcohol on every possible occasion and stamps those who refuse to indulge as eccentric or weak. Moreover, a drink should not be ordered for appearances merely, and then nipped. If a person does not care for alcohol, or finds that it disagrees with him, he should neither be misled by custom nor tempted by the scoffers. To overcome this custom is the main factor in the fight against alcoholism. Education with reference to the uselessness and harmfulness of alcohol must be addressed to the public in the widest conception of this term, rich and poor, high and low. The campaign of education, and the organisations which further it, should be materially supported by the Government. It is essential that the work be begun in the common schools, and that the dangers of alcoholic indulgence be impressed on the minds of the children.

The treatment of the bodily and mental disturbances resulting from the abuse of alcohol must be carried out by the physician. Until the arrival of the latter, a deeply intoxicated person should be wrapped up in warm blankets, hot-water bottles placed in the bed, and strong coffee, without any milk, administered. Artificial respiration may sometimes be necessary. Delirious cases should be sent to the hospital ; if they remain in the house, force in restraining them should be avoided as much as possible, as this greatly increases their restlessness and resistance.

ALKALOIDS.—A group of chemical principles found in animals and in plants. Many of these alkaloids are useful as medicines ; and most of them are highly poisonous, even in very minute amounts. The term signifies " like an alkali," and refers to the chemical behaviour of these bodies. They are alkaline in reaction, form salts with acids, and in many ways they behave like alkaline bases. In the animal kingdom alkaloids are not very numerous. The animal alkaloids, which have been called " ptomaines," and " leucomaines," usually result from the breaking down of complex organic substances which contain nitrogen. Trimethylamine, one of the simplest of these animal alkaloids, is formed in many food products as the result of putrefactive decomposition, the characteristic odour of stale fish being due in part to this substance. Other animal alkaloids are guanidine, adenine, neurine, and choline. In plants the alkaloids are very widely distributed, and many plant families contain numerous alkaloid principles. Opium, for example, contains at least sixteen different alkaloids, morphine being the most important. Cinchona-bark contains over twenty different alkaloids, among which quinine is the one most widely employed. Other families contain very few.

When obtained in the pure state, alkaloids may be either gaseous (as *mercurialine* from *Mercurialis annua*, a common European plant), liquid (as *nicotine*, in tobacco; *coniine*, in poison hemlock; and *gelsemine*, in *Gelsemium sempervirens*, the spreading trumpet-flower), or solid, as is the case with the great majority of the alkaloids: morphine, quinine, codeine, strychnine, physostigmine, brucine, cinchonine, hyoscine, hyoscyamine, cocaine, caffeine, etc.

Chemically, the alkaloids are all nitrogenous bodies. They contain carbon, hydrogen, and nitrogen, and for the most part also oxygen. The simpler alkaloids are ammonia compounds, or amines; whereas the more complex members of this group are pyridine, or nitrated benzol derivatives. In many instances their exact chemical construction is still undecided. Physiologically, the alkaloids are mostly characterised by their very powerful action on the nervous tissues. Some alkaloids (as morphine, codeine, and hyoscine) depress the nerve-cells of the cerebrum, causing sleep, or even death; while others (as cocaine, caffeine, etc.) excite the same cells, preparatory to depressing them. Still others (as strychnine) can stimulate the reflex activities of the nerve-cells of the spinal cord; while alkaloids as coniine, gelsemine, etc., may completely paralyse all voluntary muscles, by acting on the muscle end-plates. Some alkaloids have a selective action on the sensory nerve-fibres. This is particularly true of cocaine, which, locally applied to a nerve, causes it to lose its ability to transmit sensory impulses to the brain, thus stopping all consciousness of pain; motor impulses, however, can pass in the same nerve-trunk, though not in the same fibre. All alkaloids are more or less poisonous. Aconitine in doses of $\frac{1}{100}$ grain has caused death; strychnine in doses of $\frac{1}{20}$ grain has caused severe convulsions; and morphine in $\frac{1}{2}$ grain doses has caused serious poisoning. Of the various alkaloids used in medicine, quinine is one of the weakest. It may be given in doses up to 30 or more grains with only mild disturbances of the nervous system.

It has been only within comparatively recent years that the alkaloids, which in many instances represent the efficient part of a complex drug, have been isolated. It has often been claimed that homeopathy has brought about the use of the smaller doses now employed in medicine. This is not true, or is true only as a matter of coincidence. Pharmaceutical chemists have really brought about the change, for at the present time one may obtain in a small pill or capsule all the active principles in a drug which formerly could be obtained only by swallowing a cupful of a nauseous dose. By isolating the alkaloids the same amount of the active principle has been obtained, and the patient does not have to swallow the useless decoction containing the alkaloid. The chemical laboratory has done the swallowing, as it were, and has given the pharmacist the active principle in compact form. Thus it may be seen that the decrease in the size of many doses is not an actual one; it only appears so to the unthinking.

ALLOPATHY.—This term, as applied to scientific medicine, was devised by Samuel Hahnemann, the founder of the homeopathic school. He divided all remedies into three groups: (1) those which in the healthy subject produce effects similar to those for which they are prescribed in the sick (homeopathic drugs; see HOMEOPATHY); (2) those which produce a different train of symptoms (allopathic drugs); and (3) those which manifest an opposing action and depress the symptoms of the disease (antipathic drugs). In the latter category Hahnemann included those remedies which brought on sleep in insomnia, stimulated the appetite where this had been lost, produced catharsis in constipation, etc. These actions are usually found associated with the ordinary household remedies. Hahnemann claimed that the homeopathic remedies employed by him were alone effective in disease; and he accused his colleagues of using allopathic and antipathic measures which were dangerous, because the patients then suffered not only from their original illness, but also from the "drug illness" and the other symptoms which had been repressed.

The word "Allopathy" was used by Hahnemann exclusively as a term for producing agitation and as descriptive of a method which, according to his views, was detrimental, dangerous, and useless, as compared with the procedure devised by himself. With the lapse of time the old controversies regarding homeopathic, allopathic, and antipathic schools of medicine have all been swallowed up in newer and more important interpretations. Medicine, as a science, has advanced so rapidly that almost every theory fifty years old or more has had to be modified. Thus, the word "allopathic," to distinguish it as a school of medicine, has ceased to have any significance, and is rarely used at the present time. It never has been a designation for any real idea—it was simply a term used by Hahnemann to represent something different from that which he himself taught. The practical work of medicine is carried on by human minds, and must therefore reflect the various inclinations and points of view of different individuals. It is a fact that there is less divergence of thought in the minds of practitioners of medicine at the present day than there has ever been, and there are fewer special methods claiming great merit than ever before. This is largely because of the closer relations that exist throughout the world; and truths of medicine which in times past took centuries in going from country to country are now flashed around the world in a few minutes. At the present time, following the announcement of a new medical idea, thousands of physicians in all parts of the world are putting the new thought through the tests of experience; and the results of these are soon made known in medical literature, so that the new idea is established or falls in a comparatively short time. This is tending to bring all schools of medicine on a common footing; and the innermost parts of China are to-day less isolated from medical research than were the countries of Europe one hundred years ago, in Hahnemann's day.

It is becoming apparent every day that a most important factor of evolution is mental. People who regulate their lives wisely do not have to suffer as much as those who do not ; and this important factor even enters into the choice of the family physician. A poor doctor gives poor results ; they may not be detected for a year, or sometimes not in many years, but the law of evolution in the mental sphere punishes the man whose judgment is defective in the choice of his medical adviser. The layman recognises this, and thus seeks for the best equipped man he can find.

ALMOND, BITTER.—The ripe seed of the *Amygdalus communis amara*, a native of Western Asia and extensively cultivated in the tropics. It is particularly interesting because it contains an active glycosid, *amygdaline*, which on contact with water develops a very active acid, hydrocyanic or prussic acid. See Prussic Acid.

ALOES.—The dried juice of the leaves of a number of species of the genus *Aloe*, southern members of the lily family, grown in Barbados and in other islands of the West Indies, and farther south. Some of the species yielding aloes are found also in Africa. The active principle of the drug is known as *aloin*, which is an anthraquinone derivative. It is intensely bitter and resinous to the taste, and stimulates the movements of the intestinal tract. It causes increased flow of bile from the gall-bladder, but has no direct effect on the liver. Its chief action, however, is confined to the lower bowel, and it is for this reason that it is so widely used in the treatment of chronic constipation. Given alone it is apt to cause griping, and it is widely used in pill-form combined with aromatic substances. The usual dose of aloes alone is from one to five grains. It is an unsafe remedy for pregnant women, especially in large doses. The intestine gradually becomes habituated to it, as to all other cathartics, and it loses its effect with comparative rapidity.

ALUM.—The double sulphate of aluminum and potassium. It is largely formed in the manufacture of coal-gas, although a number of minerals can be used in its manufacture. Applied locally on the skin, alum has a slight astringent action, and is an efficient antiseptic ; but its chief action is on the mucous membrane, where it causes a characteristic puckering and astringency, whitening the mucous membrane, thickening it, and making it tough. It also diminishes the secretion from the mucous membrane, and is widely used as a mouth-wash and in the treatment of leucorrhœa. For such conditions it should be well diluted, 20 grains of alum to an ounce of water being a fairly safe mixture. It is useful as a swab in sore throats ; and dried alum applied on a piece of cotton to canker-sores is usually efficacious in rendering them sterile and aiding in their healing.

In large doses alum is poisonous, acting as a metallic astringent. The dried alum is a much more powerful caustic than the ordinary crystalline alum. Internally, alum has been used in the treatment of lead-poisoning,

but it is doubtful if its internal use is very efficacious. As an emetic it may be given in teaspoonful doses.

AMAUROSIS.—Term designating blindness caused by a disease, principally of the retina or optic nerve, occasionally congenital. It may result from gout, or from poisoning by wood-alcohol, grain-alcohol, lead, tobacco, or anilines. Amaurosis may develop from tumour of the brain, from locomotor ataxia, and from brain syphilis. It is not infrequently found in advanced disease of the kidneys.

AMBLYOPIA.—A dimness of vision; to be distinguished from loss of vision, AMAUROSIS. Many of the conditions causing amblyopia will, if operating for sufficient time, cause amaurosis. Thus poisons, such as alcohols and lead, may at first cause only partial blindness; but if the poison acts for a considerable period of time total blindness may result. In kidney-disease amblyopia, at first transitory, may ultimately develop into true optic atrophy with resulting blindness. All cases of partial blindness should receive immediate attention, as they may be precursors of total blindness. It should be remembered that there is a form of hysterical amblyopia which often baffles all but experts in diseases of the eye and nervous system.

AMMONIA.—A volatile acrid gas with a burning taste and an extremely irritating and suffocating odour. In a concentrated solution it is a very active caustic, being capable of burning the skin and mucous membrane. If taken internally it acts as an alkaline caustic, burning the mucous membrane of the mouth, œsophagus, and stomach, and being capable of causing death from shock and collapse. The gas itself when inhaled in undiluted form may produce death by reason of its irritating action on the glottis, which causes the mucous membrane to swell and brings about suffocation. If well diluted, as in the frequently-used smelling-salts, which consist mostly of ammonium carbonate, it has a very pronounced stimulating effect on the mucous membrane of the nose, and through these stimulating qualities it reflexly strengthens the heart-beat. When combined with aromatic substances, as in the familiar smelling-salts, it serves a useful purpose as a quick heart stimulant, being particularly valuable in fainting, in snake-bite poisoning, and after anæsthetisation by chloroform or ether.

Ammonia-water sufficiently well diluted is a very useful remedy in gastric acidity. It is particularly valuable, locally applied, in relieving the irritation caused by the bites of insects. In the form of aromatic spirits of ammonia it is a swift, though evanescent stimulant, and is very widely used in the treatment of intoxication. Ammonia-gas itself is never used in medicine, but the stronger ammonia-water, containing 32 per cent. of the gas, and the weaker water, containing 10 per cent., are widely employed. The former, however, while very useful for household and cleansing purposes, should not be used internally. In cases of poisoning resulting from the accidental swallowing of strong ammonia-water, it should at once be diluted with water

and vinegar, and the stomach evacuated as speedily as possible. Ammonium carbonate, one of the commonest of the salts of ammonia, is widely used in cough-mixtures as a stimulant and expectorant, increasing the flow of mucus, and thus rendering the cough less violent and the mucus less tenacious. The chloride of ammonia is also used for much the same purposes, and in the form of troches it is widely employed for the treatment of sore throats.

AMNESIA (FORGETFULNESS).—See Speech Disturbances.

AMPUTATION.—An operative procedure, which is not now resorted to as frequently as in former years. This is due primarily to the great advancement in the treatment of wounds, so that many limbs are preserved which formerly would have been sacrificed in order to save the life of the patient. Amputation is, moreover, not as dangerous, and this is also the result of modern attainments. Death rarely occurs in consequence of the operation itself, and the newer methods aim to secure a stump which will remain serviceable to the patient. The knowledge of the manufacture of artificial limbs has also made great strides, and there are models provided with acting knee-joints. Those who are unfortunate enough to require amputation of a limb owing to severe injury or disease, have the prospects of an existence much more comfortable and useful than would have been their lot in former days.

AMYLENE HYDRATE.—A complex alcohol widely used as a sleep-producing remedy. It is of particular value in inducing sleep when the sleeplessness is due to worry and overwork and not accompanied with pain. It is usually given in doses of from 15 drops to one-half teaspoonful. In large doses it depresses the heart and brings about a condition almost identical with deep intoxication.

AMYL NITRITE.—A nitrite prepared from one of the higher alcohols, and being a volatile oily liquid with a very characteristic banana-like odour. It is rarely used internally, being administered in the form of a vapour, five drops of amyl nitrite usually being enclosed in a glass-pearl. This is broken in the handkerchief and the volatile gas inhaled. Taken in this manner it causes a distinct sense of fullness in the head, which is followed by dilatation of the blood-vessels of the face, roaring and buzzing in the ears, and even by a certain amount of staggering and unconsciousness. The respirations are hurried, the heart-action is increased in force and rapidity, and the blood-pressure sinks rapidly. The chief action of the drug is on the blood-vessels, where it acts on the unstriped muscle-fibres, causing them to relax.

Amyl nitrite is used particularly in those diseases in which sudden acute contraction of the blood-vessels may result in sudden death or serious accident (as in angina pectoris), and in some instances it may be efficacious in cutting short an epileptic attack. It is used also in the treatment of some forms of sick headache, especially when accompanied by high pulse-tension, cold and clammy skin, pinched nose, and general discomfort. Its action is

very rapid, but also very evanescent, and it is not well adapted to continuous use.

AMYLOPSIN.—A starch-digesting ferment found in the pancreatic juice. It has the power of converting about twenty-five times its own weight of starch into glucose. See PANCREAS in INTRODUCTORY CHAPTERS, *s.v.* ORGANS OF DIGESTION (p. 150).

ANALGESICS.—Agents that diminish pain. These may be either agents that are applied locally, and exert their influence on the ends of the sensory nerves; or they may be remedies which are given internally and either act on the centres of consciousness in the brain, benumbing the sense of pain, or exert their influence on the sensory end-organs through the medium of the blood-vessels. In the former class belong those that act on the skin and those that act on the mucous membrane, many of which are very widely used in medicine at the present day. As the skin does not absorb very readily, acting usually only through its sweat-glands, many analgesics which are extremely effective when applied to the mucous surfaces have little or no action on the skin. Cocaine is an excellent illustration of this general principle.

Of the analgesics that are used on the skin, cold and heat are of immense importance. Ice-bags and hot-water-bags are very useful in reducing the pressure of inflammation, thus indirectly alleviating pain. Freezing mixtures, such as ethyl chloride, etc., are highly efficacious in causing local analgesia, and these mixtures are frequently employed to render the skin insensible, so that minor operations can be performed without pain.

A large number of aromatic compounds, particularly combinations of phenol, of menthol, of thymol, etc., are of immense service in relieving pain by local application. Thus, oil of wintergreen, which is so very widely utilised for local neuralgias and for muscular affections resembling rheumatism, is one of these aromatic compounds, being methyl salicylate, which is closely related to carbolic acid.

Another class of remedies that are utilised as local analgesics on the skin are the various preparations of belladonna, particularly ointments and plasters. Belladonna has the property of destroying the sensibility of the ends of the sensory nerves in the skin, which accounts for its efficacy in neuralgias and painful affections of the muscles, such as lumbago, backache, stiff neck, etc.

The local analgesics most widely used on the mucous membranes are cocaine and its allies. The action of these agents on the inflamed mucous surface is rapid, but very evanescent, and it should never be forgotten that the relief from pain is often gained at the expense of acquiring a lifelong and destructive habit. Within recent years a number of closely related compounds have been used for local analgesics on mucous surfaces, eucaine, holocaine, etc., being examples. In addition to these a number of benzoic

acid derivatives have also been widely employed, and have the great value of being more persistent in action and less liable to induce a habit. These local analgesics for the mucous membrane are of particular value in inflamed conditions of the nose and throat, especially in tuberculous laryngitis and in ulcer or cancer of the stomach.

Of the analgesics that are used internally it may be said that it is fortunate that medicine has at its command a large variety. Whereas in ancient times opium was almost the only pain-destroying remedy which the physician possessed for internal medication, he now has at his command twenty or thirty excellent remedies for producing the desired result. Naturally, opium stands at the head of the line as the most effective pain-annulling remedy. But its use is attended with great dangers, and countless lives are sacrificed on the altar of morphine and opium habits.

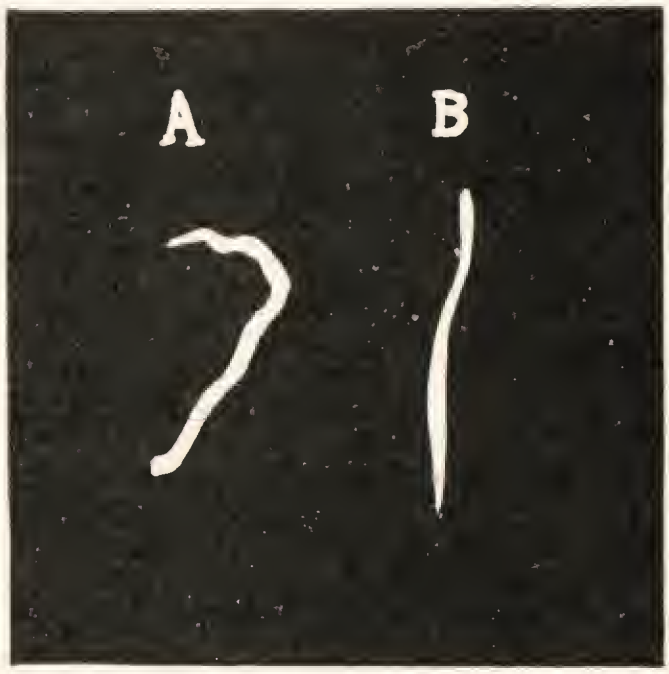


FIG. 72. Anchylostoma duodenale (the cause of Anchylostomiasis). A, male; B, female.

Of the newer analgesics, antipyrine, acetanilide, phenacetine, and their allies represent the most important groups. These are particularly valuable in the treatment of neuralgic affections, headache, menstruation pains, influenza pains, and the various pains in muscles and joints which result from acute and chronic rheumatism, etc. Their use is attended, however, with constant danger; and many instances of severe poisoning and even death are recorded from the too free and indiscriminate taking of these remedies. They are quite dissimilar in their action in certain individuals, and no layman should dose himself with them or with any of the many headache-powders and pain-destroying remedies that are so widely placed on the market. The great danger that is caused by these drugs, particularly by acetanilide, and in a less degree by the phenetidines, is the destruction of the red blood-cells. This is an accident which is often very serious.

ANATOMY, HISTORY OF.—See MEDICINE, HISTORY OF.

ANCHYLOSTOMIASIS.—Term denoting a special disease which was first observed in bricklayers and in workers in tunnels, but at present is found extensively in mines throughout the world, having been transported from place to place by infected miners. It is caused by a worm (*anchylostoma duodenale*; see Fig. 72) which settles on the mucous membrane of the small intestine, and lives on the blood it sucks. This results in a considerable degree of anæmia, which may be accompanied by bloody diarrhœa, respiratory difficulties, palpitation of the heart, dropsical swell-

ings, great weakness, etc. The disease is recognised by microscopical examination of the fæces, in which the eggs of the worm may be found. Within recent years it has become apparent that this disease is very common in the southern United States; and it has been found that a distinct species, *Anchylostoma* (*Uncinaria*) *Americana*, is responsible for the American disease.

Treatment consists of medicines (to be prescribed only by a physician) for killing the worms, and of purges and enemas. The chief prophylactic points to be observed are:—disinfection of the intestinal evacuations, provision of pure drinking-water, and the observance of scrupulous cleanliness on the part of the workmen. The diseases caused by tape, thread, and pin worms are described under separate paragraphs. It should be added that frequently, especially in the case of children, all sorts of complaints are ascribed to "worms" which often are due to different and more serious causes. Therefore, if more serious disturbances appear, it is wise to have the child examined by a physician. A microscopical examination of the fæces should be made in every case called "worms."

ANÆMIA.—Deficiency of hæmoglobin or of red blood-corpuscles. According to the views of the laity, there is no complaint easier to recognise than an anæmic condition of the blood. Paleness of the skin is admitted to be an infallible sign of poor blood, and if a member of the family is stated to be suffering from this complaint, the question is almost universally asked, "shall not he or she, as the case may be, take iron?"

In the presence of such generally accepted knowledge, any further explanations would appear superfluous. For the layman argues that as the pale condition of the skin which he sees and the various symptoms of which the patient complains are due to anæmia, and that the impoverished state of the blood is caused by a lack of sufficient iron in the system, the only rational treatment by which all the disturbances may be allayed is to administer iron freely. Nevertheless, it is very easy to prove that these conclusions are superficial and erroneous, and that iron is not an infallible remedy for this affection. A gardener would certainly ridicule the notion that the fading and blanching of the leaves of a plant could be prevented by enriching the soil with iron. Everyone who is conversant with plant life knows that in producing this condition a great number of factors are at work, among which may be included insufficient or over-abundant light, too much or too little heat or moisture, the composition of the soil, in which of course the proper modicum of iron must be present, and finally, parasites, either resident on the plant or in the surrounding earth.

That iron alone does not meet all the indications with which it is credited, is evidenced by the fact that there is appearing a constantly increasing number of iron preparations, which are claimed to be more easily digested and therefore possessed of greater tonic properties; and furthermore that

in successful cures, important hygienic rules have been prescribed in addition to the iron medicine. Constant experience and careful observation must make it plain to all who are willing to learn that, particularly in these disorders of the blood, it is extremely essential that each individual case be submitted to the test of a medical examination, and that treatment be determined accordingly. For we are not merely concerned with giving an appropriate name to a disease based on its external characteristics, but we are required as a precautionary measure to determine the cause, the error in the conditions of life, which brings about these disturbances.

The blanching of the leaves has been chosen as an illustrative example of the various causes which may underlie what is apparently but one disease, because this change in colour bears a close resemblance to that which gives rise to the popular conception of anæmia. And not only this, but in both of these manifestations there is, in so far as a comparison can be drawn between animals and plants, a similar pathological process underlying each. The green colour of the leaves is due to a colouring agent, the chlorophyll, just as the red colour of the blood is due to a similar agent, the hæmoglobin.

The blood consists not only of an albuminous fluid, in which are contained the numerous salts and other substances necessary to the growth of the body, but it also contains an enormous number of minute cells of various forms and sizes, which, according to their colour, are described as red or white blood-corpuscles. The red cells, which are far more numerous than the white, contain the red colouring-matter, which gives to the blood and the tissues supplied by it their characteristic colour. This substance permits the red cells to absorb and retain the oxygen supplied to the body through the agency of the respiratory organs. The more completely this is done, the more intense is the red colour of the corpuscles, and the greater their ability to carry out the metabolic exchange to the welfare of the tissues in the body. A rugged, blooming colour of the skin may therefore with entire justice be looked upon as an evidence of health. The complexion does not, however, depend entirely on the number, nor on the intensity of the colour, of these corpuscles, but also on the degree of dilatation of the blood-vessels in the skin and on the transparent and tender character of its layers. For these reasons it is apparent that changes in the complexion are dependent upon: (1) a decrease in the number of red blood-cells; (2) a diminution or change in the character of the red colouring-matter; (3) a true scarcity of blood; (4) an irregular distribution of the blood, there being more in the internal organs than at the surface of the body; and (5) the character of the superficial layers of the skin, which are sometimes particularly rich in a deposit of yellow or dark pigment, thereby offering an obstruction to the passage of the light-rays emanating from the red blood-cells. There are families, and even races, who are possessed of a pale, tender, and yellowish skin, without being at all anæmic; and it is necessary for the physician to

determine whether the pale or yellowish complexion has developed gradually, or whether it is peculiar to the family in question.

A transitory blanching of the skin is often seen in delicate and frail persons, who, especially during the winter, afford the impression of being anæmic. In other cases nervous influences may serve to direct a greater amount of blood to the internal organs than goes to the skin. It is well known that persons suffering from cold hands and feet often complain of a rush of blood to the head or give evidences of abdominal congestion as shown by various digestive disturbances and hæmorrhoidal conditions. Furthermore, it is a matter of common observation that anæmic individuals may suddenly show a bright red flush, which clearly proves that a pale complexion need not necessarily be due to a lack of blood or insufficient activity of the red blood-cells, but may be caused by a faulty distribution of the fluid dependent upon nervous influences. When this condition is accompanied by vertigo, noises in the ears, and cardiac palpitation, it may be taken for granted that the symptoms are those of actual anæmia, and that as the blood rushes to the surface of the body, the internal organs are more or less depleted of their proper quantity of blood. The flushing of the face in such cases is often falsely attributed to congestion of the brain, whereas the very opposite condition, an anæmia, is present. The following varieties of anæmia must be distinguished :

(1) *Chlorosis*, which depends on the diminution to a greater or less extent of the colouring-matters of the blood. The name which is applied to this condition is derived from the Greek, and refers to the characteristic yellowish-green complexion of the afflicted individuals. See Plate XIV., Fig. 4.

(2) *Anæmia*, which refers to an insufficiency of the essential components of the blood,—albumin, salts, etc. The watery constituents of the blood may be increased, however, so that the total quantity of fluid remains the same, or it may even be increased. This condition is termed hydræmia or "watery blood." In the severer forms of this trouble, the total amount of the red colouring-matter may also be decreased, and on puncturing the skin an almost colourless drop of blood appears, which is only slightly sticky and coagulates with difficulty. This may be looked upon as due to a faulty admixture of the elements of the blood. It is not in all cases due to dietetic causes—that is, to unsuitable nourishment.

(3) *Complete Anæmia* or *Exsanguinity*, characterised by the diminution of the blood in the body, in some instances to such an extent that on pricking the finger no blood flows from the wound. This condition is usually brought about by the sudden loss of a large amount of blood, or is due to long-continued, severe illness.

(4) *Local Anæmia* or *Depletion*, a condition of abnormal distribution of the blood in some particular region of the body.

(5) *Leucocythæmia*, a disease which, in addition to other changes, is characterised by an often enormous increase of the white blood-cells, and in the severe cases accompanied by a diminution in the number, and a change in the shape, of the red cells. Although the well-marked paleness which is present in this disease may at first lead to confusion with ordinary anæmia, the true nature of the condition soon becomes evident, as the pathological processes in the blood-forming organs, the spleen, the lymphatic system, and the marrow of the bones, lead to well-defined enlargement of the various lymphatic glands.

The facts that pale persons may be neither chlorotic nor anæmic, that anæmia of a mild degree may not always be evidenced by a pale complexion, and that several processes may be concerned in the production of this class of diseases, make it clear that an exact diagnosis of the complaint cannot be made from the mere impression afforded by the colour of the skin. It is always essential to make a careful chemical and microscopical examination of the blood of each patient. When in any given case it has been determined that some change in the blood is the basis for the symptoms of which the patient complains, and after it has been decided which of the organs concerned with the formation of the blood is diseased, it still remains to remove the cause of the disturbances before any definite indications for the treatment can be formulated. It is necessary, therefore, in every case to determine whether the therapeutic measures shall be directed to any one organ which may happen to be diseased, or whether unfavourable and unhygienic conditions are alone at fault and must accordingly be corrected.

It is evident that the faculty of inspection, however acutely it may be developed in the physician, does not offer any royal road to correct diagnosis in the domain of blood-disorders. The generally accepted opinion of the laity in reference to the ease with which anæmia may be cured, and that the administration of iron is the great panacea, may well be met with ridicule by those who are acquainted with the complex constitution of the blood and the many and varied causes which may underlie changes in its composition. The mistaken conception, that anæmia is due entirely to the lack of a sufficient quantity of iron in the blood, may be traced, as in numerous other instances, to a confusion of the effect and the cause. It is true that iron is lacking in the blood, but only so because the blood-forming organs, and among these must be included the digestive system, are not acting properly. The blood-cells become diseased because these organs interfere with the absorption of the iron present in the food; and also because they do not develop in sufficient amounts other constituents which are necessary components of the blood. In the majority of cases, therefore, a lack of iron is not the cause of the illness, but the latter is the immediate result of a weakness of certain organs.

The more important causes of blood-disorders must be definitely known if it is intended to overcome them. In the first place they may consist of some constitutional failure; that is to say, the blood circulatory system of some individuals may be afflicted with a certain predisposition to these disorders, just as a person may squint from the time of birth, or present crooked limbs. Then, again, the cause may arise during subsequent development. It is known that the transition from childhood to puberty is marked by many changes. In the female, as the time of puberty is reached, there occur numerous changes in the circulatory system associated with the development of sexual activity, and for this reason girls, during certain years of their lives, are more apt than boys to become afflicted with disorders of the blood, especially if their surroundings are unfavourable. But even where the conditions are more favourable, the transition may sometimes be accompanied by changes involving the entire system, which may persist for a long time and even extend through life, unless this period of development is permitted to go forward under the most careful prophylactic measures. During this time girls should not be permitted to indulge in over-exertion involving either the body or the mind, and their nutrition should be carefully looked after. Boys should receive similar care during this period of development, for they also exhibit general changes as well as particular ones in the circulatory system, but in a less marked degree than girls. It is incorrect, therefore, to associate anæmia with the female sex entirely.

Abnormal external influences may cause anæmia, if they exert their effects on the system for a protracted period, or continuously, and in this way inhibit the activity of the individual organs. Among the more important of these conditions may be mentioned: insufficient nourishment; dark, unhealthy, cold, and damp living-quarters; the effects of extreme heat or cold either in the open air or in poorly ventilated work-rooms; over-exertion, either bodily or mental; lack of sufficient sleep or improper sleeping accommodations; any occupation which necessitates a stooping posture, so that proper respiration is interfered with; excessive or insufficient muscular activity; exertion which includes but one side of the body; and, finally, marked mental disturbances. Attention must also be directed to the harmful character of the corset, which not only interferes with the normal expansion of the thorax, and the entrance of the air to the lungs, so that the ready combination between the oxygen and the red blood-cells is prevented, but also exerts pressure on the important digestive organs, the stomach and liver, and in this way obstructs the abdominal circulation and the necessary movements and expansion of these organs. Indigestion and constipation result from the latter conditions and are accompanied by numerous painful sensations.

It is the function of the physician to determine which of these numerous factors are the essential causes of anæmia, bearing in mind that season and

other circumstances may largely influence these conditions. Thus, many persons are capable of doing considerable muscular work in the winter, which it would be impossible for them to accomplish in the summer; while others, apparently, are harmed only by their exertions during the winter, although this may be due to the fact that they cannot get along without the proper amount of sunlight, or that an atmosphere which is very dry or very moist has an unfavourable influence on respiration and muscular activity. The change from one season to another has an important bearing on the production of anæmia and other blood-disorders, so that in some latitudes a summer and winter anæmia can be differentiated; and persons are seen who suffer regularly either in one or the other of these seasons from symptoms of anæmia. This is due to the fact that the changes induced in the blood circulatory system by the passage of the seasons cannot be withstood on account of some constitutional weakness or especially unfavourable surroundings; or that the influence of some characteristic attribute of the seasons—heat, cold, dampness, etc.—cannot readily be overcome. The transition must be gradual in order that the individual may become accustomed to the change; and the production of severe catarrhal troubles with the advent of either spring or autumn is a matter of common observation.

Marked changes in the circulatory system and in the blood may be caused by a great variety of diseases, among which may be primarily mentioned those of the digestive tract, the infectious diseases, and inflammation of the kidneys. Both anæmia and chlorosis may develop in children after an attack of summer diarrhœa, measles, scarlet fever, malaria, diphtheria, etc., or in adults after typhoid, although the disease may have appeared very mild and run a short course.

It is natural to suppose that the various chronic diseases of important organs, such as chronic pleurisy, pulmonary tuberculosis, cardiac diseases, Bright's disease, and long-continued suppuration, should lead to marked changes in the character of the blood.

In some cases intestinal parasites may be the cause of the anæmia, and patients should therefore not be definitely treated for the condition unless an examination of the stools in suspicious cases has been made. Many a case of anæmia with severe digestive disturbances has been cured by the administration of a vermifuge. During late years new forms of intestinal parasites have been imported and are now endemic. A condition now found sometimes among miners is the "hook worm" disease, or "tropical chlorosis," which is due to a round worm, the *Anchylostoma duodenale*. Pregnancy and labour also exert their influence on the state of the blood.

The surroundings of the patient must be taken into consideration when there is some doubt as to the cause of the disease; for these may lead to

the production of an anæmia where a tendency is present in the individual, or, if only slight evidences are at hand, may bring about a more severe degree of the affliction. Even hygienic measures which may be of signal value under certain circumstances, may sometimes lead to a very harmful result, because they have been falsely applied. For example, when apparently perfectly healthy children who are growing actively and using up all their energies in accomplishing this growth, show a certain degree of fatigue and lassitude, because the nourishment demanded by the muscles is greater than the system can supply at once, it is an error to subject these children to cold baths or to urge them to swim, with the idea of strengthening their muscular system. As a result of such treatment very severe degrees of anæmia may develop, because the body is unable to meet the double demands necessitated by increased muscular growth and the effort to keep warm. See SWIMMING.

Harm is also done by the well-meant efforts to improve the anæmic-looking child by attempts at over-feeding with plentiful and rich food. A weakened digestion and insufficient secretion of gastric and intestinal juices, together with diminished muscular exertion, does not require an abundance of eggs and meat. Even milk taken in large quantities may do harm, if the desire for albuminous foods is indicated by an improved appetite. The giving of wine had also best be omitted, for this beverage does not supply the constituents which are lacking in anæmic blood. Although red wine, on account of its supposed contents of iron, is often warmly endorsed for this purpose, it fails to accomplish the object sought.

The manner of life of a child, although carried out under what are apparently the most favourable circumstances, exerts a harmful effect on the development of its body in more cases than is generally supposed. First of all must be mentioned the influence of the school, the confinement in poorly ventilated school-rooms, and the development of the mental, at the expense of the bodily, functions ; insufficient exercise in the open air contributes to the neglect of the latter, especially if a portion of the time after school-hours is given up to music or other accomplishments. The effects of life in large cities and the demands of present-day society also exert their harmful influences. Children and young people do not get enough sleep, and a lack of sleep is as distinctly harmful as insufficient nourishment. Early school-hours rob the children of the large cities, where a timely retirement is often prevented by a multitude of circumstances, of a considerable portion of the refreshing morning-sleep. No words need be wasted in doing more than allude to the baneful effects of social amusements which extend into the early morning-hours, and of the exertion attendant upon dancing in hot and close rooms. Happily, the love of outdoor sports partially counterbalances this tendency, but these should be indulged in with the thought uppermost in mind that the abuse of muscular activity, especially in the

undeveloped body, may do a great deal of damage, and in certain grades of anæmia must be entirely avoided.

The symptoms of anæmic persons are due to the fact that the poorly constituted blood cannot sufficiently nourish the various organs. Up to a certain point this is made up by more active circulation and deeper respirations ; that is to say, both the lungs and the heart are compelled to work harder and faster in order to supply the body with the necessary quantity of oxygen. When this can no longer be kept up, those organs which are most in need of constant and appropriate nourishment—the heart, muscles, and brain—are the first to exhibit an inherent weakness. In anæmic and chlorotic individuals the breathing is, therefore, more rapid, and the pulsation faster than in healthy persons. The former often complain of a sudden respiratory embarrassment which is looked upon as asthma ; excitement or exertion, especially rapid walking or going upstairs, " takes their breath away," and they become afflicted with palpitation. The muscles, as is shown by their bright red colour, contain a large amount of the blood-colouring matter, the hæmoglobin, and even during quiet they require large quantities of oxygen. Naturally enough, this demand for oxygen and hæmoglobin is quickly increased when these muscles are thrown into a state of activity ; and if the blood is deficient in these constituents, the other organs, particularly the brain and skin, will suffer, because their allotment is drawn away to supply the muscles. As a result, the patients are seen to grow pale at almost every exertion, and they complain of headaches, vertigo, and flickering before the eyes.

When the blood supply is insufficient even for moderate bodily movements, there soon ensues a feeling of fatigue, and sometimes this is accompanied by severe and obstinate muscular pains. These are especially marked in the calves of the legs and in the back, and this fact should be borne in mind in chiding anæmic persons for the stooping posture which they usually assume. In the course of time the muscles of the chest and the abdomen also become sensitive, and the patients complain of constant, or transient, deep-seated pain, often in the early morning, in various localities, especially between the ribs and in the pit of the stomach, also of difficult respiration and abdominal cramps. On account of the sensitiveness of the abdominal muscles, the pains are increased at every meal time, often to such an extent that the patients will forego their food rather than endure the discomfort. The abdominal distress is sometimes mistakenly attributed to disease of the internal organs, such as the liver and stomach ; and the pain in the chest to affections of the pleura, the lung, or the heart ; sometimes it is difficult even for the physician to make a definite diagnosis. Attacks of pain in anæmic persons, which are usually designated as neuralgic, are often, as a matter of fact, nothing but muscular pains, although, on account of the sensitiveness of the nervous system, nervous pains do occur. Anæmic

persons are readily tired, exhibit a feeling of languor, and are usually chilly, although they are subject to congestion of the blood in various regions. They are often troubled by toothache and headache, very irritable, easily excited, and either have difficulty in falling asleep or else are constantly drowsy. In the latter case prolonged sleep is most essential.

In the severer grades of anæmia the complexion appears yellow or a greenish-yellow; and the skin, owing to the more watery character of the blood, loses its elasticity and pliability and becomes puffy. Aided by a weakened heart, this also brings about a swelling around the ankles and over the shins, especially in persons who have to stand a great deal. An improvement in the condition of the blood rapidly causes the disappearance of these symptoms. As a rule, the urine is pale and watery in proportion to the paleness of the skin, and the bile likewise is not so deeply stained, so that the stools have a very light colour. As the food is not properly assimilated by the body, a great deal of it remains undigested as a waste product, and various digestive disturbances result. Hunger, which serves as an indication of the necessity for taking food, and appetite, which is the expression of a desire for some particular kind of food, both become lessened; or there may be alternating periods of extreme greed for food, followed by a complete loss of appetite and an aversion against food, especially against a stimulating or albuminous diet. The intestinal movements become steadily lessened, and constipation results, with much flatulence and colicky attacks, because the gut may become very irritable and the accumulated masses of hard fæcal matter can only be evacuated with difficulty.

Various disturbances of the appetite may appear before or after the condition just described is developed, although hunger, properly speaking, may be entirely absent. The patients manifest an uncontrollable desire for certain substances which either serve as substitutes for those which are necessary for proper digestion, or as chemical or mechanical counter-irritants against abnormal sensations. Some of these increase the secretion of the gastric juice, and the act may be compared to the ingestion of sand by birds, which acts on the stomach-juices or aids in the mechanical disintegration of its contents. An interesting example is afforded by the dirt eaters of South America, who almost invariably are anæmic by reason of intestinal parasites, *Uncinaria Americana*. A definite indication for medical treatment is afforded by the well-marked desire of these patients for salty or acid dishes, which make good to a certain extent the deficiency of hydrochloric acid in the gastric secretions. This desire may be gratified without fear, but absolute denial should be extended to the longing for various indigestible articles such as chalk, coffee-beans, etc., which not only irritate a stomach poorly supplied with blood, but do not afford any nourishment to the body. The apparent advantage gained by the increased secretion of saliva and gastric juice which is brought about by the ingestion of these substances is

more than offset by the introduction into the stomach of indigestible materials, and the physician may well direct his attention to more suitable remedies. Neither is it wise to give way to the repeated desire for strong spices ; in such cases the digestive secretions are sufficiently stimulated by eating a little dry bread with salt, dried fruit, simple bitters (herb teas), or by the administration of medicines prescribed by the physician. Meat and albuminous foods require a considerable amount of digestive fluid for their complete and proper digestion, and for this reason their use in anæmic patients should be restricted as much as possible ; if given, acids should at the same time be administered. When the feeling of hunger is absent, the diet had better consist principally of rice, mashed potatoes, toasted bread, fruit, buttermilk, white (cream) cheese, and farinaceous soups with milk.

The more advanced disturbances of nutrition become manifest in various organs in the course of the disease. Gastric ulcers and hæmorrhage may result, also nosebleeding. The monthly periods may be diminished or extended, and such irregularities are among the earliest and most important evidences of abnormalities in the blood. It must not be forgotten that an apparently free bleeding does not necessarily signify the loss of any considerable amount of blood, as this fluid possesses marked staining powers ; on the other hand, a comparatively small showing may consist entirely of pure blood. Any considerable loss of pure blood from this source may in itself be a contributing factor in producing anæmia. Also, other disturbances may result, among which may be mentioned mucus or purulent discharges from the female genitals, which are apt to bring on a great deal of discomfort and soreness of the surrounding parts if neglected. That bad hæmorrhages may be the direct result of an impoverished condition of the blood is readily explained by the fact that the poorly nourished bloodvessels are unable to retain the contained blood ; and in the severest grade, the pernicious anæmia, hæmorrhage of an extreme and dangerous degree may take place.

Insufficient nutrition of the heart reduces its propulsive powers, and as a result the extremities—the tip of the nose, the ears, the fingers, and the toes—do not receive their full amount of blood, and become blanched and cold. Under these conditions the lungs are likewise incompletely nourished, and in consequence readily become diseased ; it is well known that pulmonary tuberculosis is frequently associated in its early stages with the symptoms of anæmia. Respiration in anæmic individuals must therefore be carefully watched. They should not be permitted to wear corsets, and the danger of catching cold should be guarded against by the wearing of suitable underclothes. Appropriate respiratory exercises under medical direction are to be recommended. The lungs must be carefully watched when obstinate, chronic digestive disturbances are present, as these are frequently

the forerunners of consumption, or else favour its development, because the entire body is insufficiently nourished.

The appearance of patients afflicted with the severer grades of anæmia may be difficult to distinguish from that associated with the final stages of cancer; they have a waxy look, are incapable of any exertion, display a tendency to fainting-spells, suffer from attacks of distressing vomiting, are unable to assimilate even the lightest foods, and are subject to hæmorrhages in the skin and in the various internal organs. These symptoms indicate what is known as pernicious anæmia.

It is to be hoped that this account has made it clear that a disease so varied in its aspects cannot be recognised as readily as the popular conception would lead one to believe, but that its type and its degree must be based on an intimate knowledge of the workings of the human body and of its requirements. The treatment, although considered a simple matter by the laity, is, on the contrary, surrounded by many difficulties. More is required than the administration of a universal "cure-all." The causes of the trouble must be definitely determined; and, in the majority of cases, these must be removed and a complete change in the manner of living prescribed. From what has already been said, it is evident that there may be many remedies which may be attended by an apparently favourable result when applied to the treatment of this disease. They seem efficient because the latter presents extreme variations in form and degree and may be due to a great variety of causes. What is appropriate and effective in one case may produce harm in another, because it is not only necessary to treat the anæmia or the chlorosis, but the numerous contributing causes must be laid bare and removed; and the treatment does not consist merely in the administration of iron, hæmoglobin or pepsine, hydrotherapeutics, warm baths, mountain or sea air, nor of gastric lavage, or venesection. The choice of a course of treatment, and its details, depends on the circumstances associated with the individual case, and these can be ascertained only by careful and painstaking observations.

Many cases of anæmia require no specific treatment, it being merely necessary to remove certain harmful influences and then to prescribe rules for a more healthful manner of life. In some cases such measures as exercise, cold, fresh air, and forced nutrition, which are otherwise of value, may be productive of harm rather than of good. Above all, it should be borne in mind that it is not possible to accomplish by radical measures that which can only be secured by carefully building up the general strength; and where there is well-marked diminution of muscular power, complete rest is of the greatest importance to the patient. Persons affected with the severer grades of anæmia must be treated at the first attack with as much consideration as would be extended to a patient ill with fever; and if a recurrence takes place, as occurs quite often, the manner of treatment should be like

that given to an individual suffering from a constitutional or chronic disease. This means more or less continued rest in bed, or, during warm weather, the recumbent position in a place where the patient may be bathed by the rays of the sun, care being taken that the person is not clothed too lightly. Not until the strength has visibly improved is any recourse to be had to systematic muscular exercise.

The recurrence of the disease, of which we have just spoken, affords proof that even the milder degrees of anæmia must be seriously considered and that the treatment must not be discontinued with the disappearance of symptoms which are plainly evident and the removal of which is considered by the laity to amount to a cure of the disease. A complete cure cannot be spoken of until the abnormal conditions of the blood and vascular system, which have been described, fail to reappear even when the patient must of necessity return to more unfavourable conditions of life and surroundings.

ANÆSTHESIA.—The impairment or loss of sensibility, due to action on the sensory nervous system. Such anæsthesia may be concerned with the sense of general sensibility of touch or of pain (*analgesia*); or it may refer to the loss of sense of heat or cold. It may refer also to loss of sensibility of a special sense: as *anosmia*, or loss of the sense of smell; *blindness*, or loss of the sense of sight; *deafness*, or loss of the sense of hearing; *ageustia*, or loss of the sense of taste. These anæsthesias, general or special, may be partial or complete; if due to a wound of the external part of an organ of sense, the anæsthesia may be termed peripheral; if the loss is in the brain centres, it is frequently termed a central anæsthesia. Anæsthesias may be functional, when due to hysteria, and are then not true anæsthesias; or they may be due to actual loss of nerve-substance. Their distribution is well localised and affords a fascinating problem for the nerve specialist. Agents are known that can bring about states of anæsthesia, which may be local or general. Thus, the use of cold, or of cocaine, may cause a local anæsthesia to pain; while ether, chloroform, and similar agents may cause a general anæsthesia with unconsciousness. See ANÆSTHETICS.

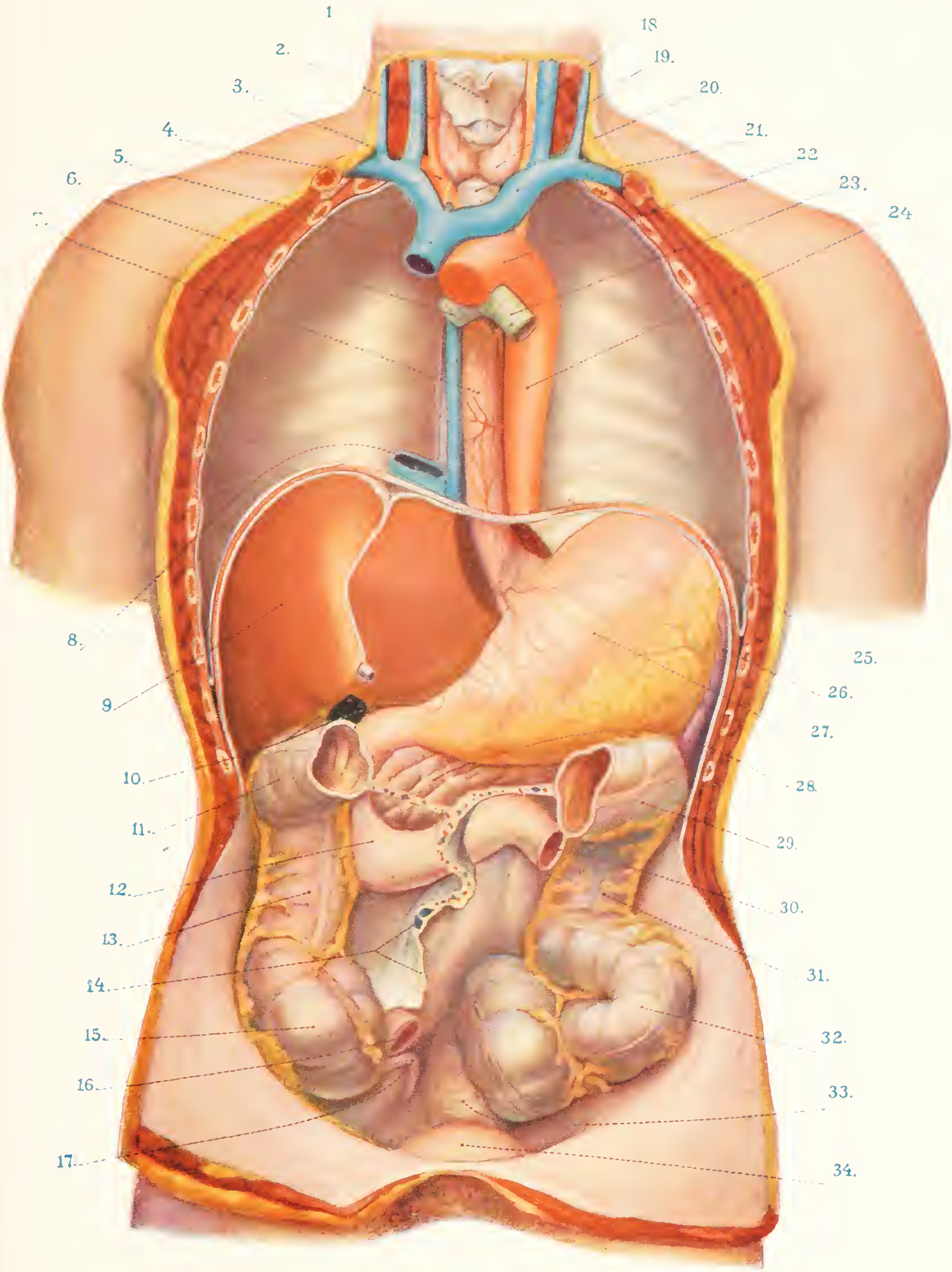
ANÆSTHETICS.—Agents which can cause a loss of sensibility (see ANÆSTHESIA). The introduction of general anæsthesia in medicine may be accounted one of the greatest of all scientific accomplishments. That it should be possible to do the most extensive operations without causing the least pain must be looked upon as a technical advance, with which scarcely any other, electricity and steam included, can be compared. The agents most commonly used are the vapours of ether, chloroform, and laughing-gas. These vapours are taken up by the blood through the medium of the respiratory organs, and are carried to the brain and spinal cord, where they inhibit the action of those particular nerve-cells which together control consciousness. So far as the actions of ether and chloroform are concerned they may

PLATE IV.—DEEP-LYING STRUCTURES OF CHEST AND ABDOMEN

(From the front)

1. Larynx
2. Right carotid artery
3. Right innominate artery
4. Right innominate vein
5. Superior vena cava
6. Right bronchus
7. Œsophagus
8. Inferior vena cava
9. Liver
10. Gall-bladder and bile-duct
11. Transverse colon
12. Duodenum
13. Ascending colon
14. Mesentery of small intestine (cut)
15. Cæcum
16. End of ileum
17. Vermiform appendix
18. Left jugular vein
19. Thyroid gland
20. Trachea
21. Left innominate vein
22. Arch of the aorta
23. Left bronchus
24. Descending aorta
25. Diaphragm
26. Spleen
27. Stomach
28. Pancreas
29. Transverse colon
30. Beginning of jejunum
31. Descending colon
32. Sigmoid flexure
33. Rectum
34. Bladder

Plate IV.


1
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18
19.
20.
21.
22
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.

be compared with the pharmacological action of alcohol, inasmuch as both are derivatives of the marsh-gas series and are chemically closely comparable with alcohol. The effects are practically the same, the important difference being one of time. As ether and alcohol are lighter and more readily diffusible, their action is more rapid. The action may be summarised as follows: At first there is a diminution in the functioning of the higher faculties, these being, as it were, separated from the rest of the nervous system and rendered inoperative; then the functions of voluntary action disappear; the sensations become dimmed; sight, hearing, touch, and taste fade away; the incoming paths of sensations are cut off, and the simplest reflexes are diminished or abolished until finally the patient is reduced to those reflexes which are of the most fundamental character and without the action of which life-processes cannot be maintained—namely, the breathing and the heart-beat.

The fact that sensation is suspended during narcosis brings with it certain risks; thus, mucus cannot be coughed up, nor can vomit be expectorated. This endangers respiration, and, although it is necessary for the anæsthetist to combat these conditions, the patient himself may do much to reduce the chances of any trouble taking place. It is well to starve oneself for twenty-four hours previous to an operation, and to provide for free evacuation of the bowels. This does not produce weakness; on the contrary, by completely emptying the stomach and intestines, the respiratory activity will not be embarrassed. The life of the narcotised person depends on keeping up a regular respiration. The patient must also endeavour to overcome the excitement natural to such an occasion, and thus to spare the heart; for the increased cardiac activity necessarily brought about by such excitement will do more to weaken the individual than is ordinarily supposed. There is one important factor in preparing for an operation, and that is complete and thorough confidence in the physician who holds the patient's life in his hands for the time being.

There is no greater reward for the operator than the confidence which he sees expressed in the patient's face as he is about to perform an operation, and which spurs him as a direct and earnest appeal to his best knowledge and abilities. On the other hand, there is no more valuable asset to the person who is about to trust his life to the care of the surgeon than this same feeling of composure and confidence in the latter's abilities. After the operation, the extreme nausea may be partially overcome if the patient will convince himself by a strong effort of the mind that it will soon pass over. Inhaling the fumes of vinegar will afford a great deal of relief. No food or drink should be taken during the first few hours. It is well to keep as quiet and flat as possible and not to get up when vomiting. The after-effects of an anæsthetic—headaches, vertigo, and a bad taste in the mouth—soon disappear. That more severe disturbances might occur, lasting

weeks or months, is an unnecessary source of worry, as these have never been definitely substantiated. For local anæsthetics, see COCAINE.

ANEURISM.—A tumour formed by a circumscribed dilatation of an artery, and most commonly developed from the aorta. Where the wall of the vessel is normal, it may result from a severe concussion of the chest or follow the lifting of a heavy weight. As a rule, however, it is produced by the gradual dilatation of some part of the wall of the vessel which offers less resistance because of the deposits of lime-salts, of fatty degeneration, or of other diseased processes. When an aneurism of the aorta has become of large size, it may manifest itself as a pulsating tumour on the anterior chest-wall. Coincident with the dilatation, there takes place a gradual thinning of the wall of the vessel, and the great and impending danger of this condition is therefore a rupture of the sac with fatal hæmorrhage. The symptoms vary in character, depending on the site of the aneurism ; they include unilateral paralysis of the vocal cords, pains in the chest which often radiate into the left shoulder and arm, sense of thoracic pressure, cardiac palpitation, etc. The latter symptoms may often be relieved by the application of an ice-bag to the cardiac region. Precautions to be observed are similar to those indicated for calcareous degeneration of the arteries. The treatment is purely surgical, combined with rest and hygiene.

ANGINA PECTORIS.—See HEART, DISEASES OF.

ANGIOMATA.—Morbid formations resulting from abnormally developed blood-vessels. A number of terms are applied to certain peculiar patches in the skin which are present at birth or developed shortly after. To the laity they are known most commonly as birthmarks, and ascribed to some mental disturbance of the mother which has become thus materially impressed on the child. This, however, is an entirely erroneous impression, as these superficial, flat patches in the skin consist of areas of abnormally developed blood-vessels. They vary in colour from red to purple or blue, are quite flat and superficially situated, and may grow rapidly after birth. The colour depends almost entirely on the preponderance of either arteries, containing bright red blood, or of veins, containing the darker, bluish blood. They are usually located on the eyelids, lips, nose, forehead, cheeks, neck, or back, and vary in size from an area as large as the head of a pin to that involving the greater part of the face. They may be surrounded by a circle of delicate, tortuous vessels, which radiate from a uniformly red centre, or they may appear as a slightly elevated, bright red patch in the skin. At other times they may extend as a broad, blue surface over the greater portion of the face, causing a considerable degree of disfigurement, often invading in addition the mucous membranes of the lips, the cheeks, and the nasal cavity. Pressure with the finger causes a blanching, but the vessels immediately fill up again as soon as the pressure is removed. As already

noted, the growth at first may be no larger than the head of a pin, but a further extension may be very rapid.

Growing angiomata should be removed at once. With the aid of an anæsthetic, they may be excised or cauterised with the actual cautery in a very satisfactory manner. The sooner parents decide to have the matter attended to, the smaller the resulting scar. The large blue angiomata can never be entirely removed, and require the most extensive operation. Cauterisation with acids and other substances is employed very often; but this procedure is by no means safe, and the effect as regards the resulting scar is usually unfavourable. If left untreated, these birthmarks may sometimes very suddenly become transformed into thick, irregular tumours made up of the enlarged blood-vessels. In other instances, they have disappeared spontaneously, but this is an exceptional occurrence, and should not lead to false hopes in any given case.

ANILINE-POISONING.—The aniline dyes have become so widespread in their use, and so many new drugs have been put on the market which are made from aniline, that many cases of poisoning, both acute and chronic, have resulted.

It is important to remember that workers in factories in which aniline dyes are widely used may be the victims of chronic poisoning. The symptoms, which develop slowly, are eruptions of the skin, increasing paleness, and headaches. Trembling in the muscles is very frequent, and patches of numbness are found in the arms and body. Blood changes may result with the appearance of blood pigments in the urine, disturbances of respiration, vertigo, giddiness, and fainting. In the case of acute poisoning, which may follow the swallowing of a large dose of an aniline dye, but more often after a dose of the modern headache-powders, the following symptoms have been noted: Headache, weakness, vertigo, blue colour to the skin, cold, clammy skin, and difficult respiration.

The cause of the poisoning in both instances is the formation from the aniline compounds of a derivative, *paramidophenol*, which has a special affinity for the hæmoglobin of the blood and prevents its ready oxidation, or which may disintegrate the colouring matters of the red blood-cells. Treatment consists in withdrawal of the poison, fresh air, oxygen, artificial stimulation, if necessary, or even bleeding and infusion of salt solution. The aniline derivatives that are mainly used in medicine are acetanilide (widely employed in the manufacture of headache-powders, neuralgic powders, menstrual pain powders, etc.), phenacetine, exalgine, lactophenine, methacetine, malarine, cosaprine, malakine, citrophene, phenocoll, apolysine, etc.; new ones are being made yearly. Only under most exceptional circumstances should these drugs be used without medical instructions.

ANISE.—The fruit of *Pimpinella anisum*, a member of the parsley family (*Umbelliferæ*), widely grown in the Mediterranean regions and in

Russia. It contains an active, volatile oil, from which is derived a phenol, *anethol*. Anise is widely employed as an aromatic in intestinal disorders, causing a warmth in the stomach, and contraction which brings about the expulsion of gases. In children's colic it has been used for this purpose, and it is very frequently combined with other remedies, such as cathartics, etc., to avoid griping. Anise furnishes the characteristic odour of certain cordials, notably absinthe and the Russian kümmel.

ANKYLOSIS.—Stiffness of a joint. Ankylosis of a joint may be either a true or a false form of the disease. In true ankylosis the bones forming the joint are grown together firmly, and the joint is absolutely immovable. In pseudo-ankylosis the ligaments of the joint and the joint-capsule are shortened, and the bones and articular cartilage are more or less grown together. In false ankylosis there is always some, if only a slight, degree of movability. These conditions of the joints are treated by manual massage, or with apparatuses and splints. For mild cases massage and medico-mechanical treatment suffice. True ankylosis can be treated only by operation.

ANTHEMIS.—The white camomile so frequently used in folk-medicine. It consists of the dried flower-heads of *Anthemis nobilis*, a low, hairy, perennial plant belonging to the aster family (*Compositæ*), extensively cultivated in Europe. It contains a volatile oil which gives it its stimulating properties. It is frequently employed as a hot infusion, in which form it stimulates the heart-action, dilates the blood-vessels, and causes an increase in perspiration and in the flow of urine. It is frequently employed in the initial stages of the treatment of influenza, colds, and similar diseases. It may also be employed in the treatment of colic in infants ; and it is a useful bitter, stimulating the appetite.

ANTHRAX.—A very dangerous infectious disease transmitted from animal (cattle, horses, sheep, pigs, goats, etc.) to man. The disease is usually acquired by handling the skin of an animal which has had the disease. It is caused by a minute bacterium, the *Bacillus anthracis*, a plant not over $\frac{1}{3000}$ of an inch in length. The anthrax bacilli (see Fig. 63) enter the body by various channels. From the point of entrance they become localised or are rapidly disseminated throughout the entire body by the blood-current, multiplying enormously at the same time. The symptoms of the disease vary according to the mode of infection. *Wound anthrax* (infection from small wounds) shows in rapid succession pain, redness, and swelling of the affected part of the skin, followed by the formation of a yellowish, bloody vesicle which ruptures and changes into a brown, later, black, crust. This "malignant pustule" is surrounded by an inflamed eminence and a far-reaching swelling of the skin, with bluish discoloration. Signs of a general infection become manifest at the same time : high, often irregular fever, which may be absent in severe cases ; headache ; pains in the limbs ; weak-

ness; stupor; blue discoloration of the face; difficult breathing; vomiting; diarrhœa; and hæmorrhages in various parts of the body.

If infection is brought about by *inhalation* of wool-dust containing anthrax spores, as in hat-makers and rag-sorters (hence, *rag-sorter's disease*), symptoms resembling pneumonia occur in the lungs. Anthrax bacilli may be conveyed with the food to the stomach and intestine, where they occasion great pains in the abdominal region, as well as eructation, vomiting, great thirst, coated tongue, distension of the abdomen, and diarrhœa. General prostration sets in rapidly, accompanied by fever and by disturbances of the activities of the heart and lungs.

Anthrax usually runs so rapid a course that it is possible only at the beginning to preserve life by energetic, eventually operative, treatment; by this means the patient sometimes recovers, even with a general infection. But usually death occurs from loss of strength, rapid lowering of the temperature of the body, and weakness of the heart. Disinfection of the clothes, linen, stools, and sputum of the patient is important. See DISINFECTION.

The disease is comparatively common in cattle. Serum-therapy for cattle is useful.

ANTIMONY.—A metal which, in its pure form, is not used to any great extent, but which, as the basis of the double salt of antimonium and potassium tartrate, *tartar emetic*, has an important place in medicine. When rubbed on the skin, tartar emetic has an irritating action, causing redness, and it acts on the sweat-glands, bringing about a fine, papular eruption not unlike the eruption of smallpox. Its continued application may cause suppuration and gangrene of the skin. Tartar emetic has a slight acrid taste, and taken internally in very small doses it stimulates the appetite, and is capable also of causing slight stimulation of metabolism. In larger doses (*i.e.*, of $\frac{1}{20}$ to $\frac{1}{8}$ grain) it brings about dilatation of the blood-vessels, causes relaxation of muscular spasms, and profuse perspiration. In still larger doses (up to $\frac{1}{2}$ or 1 grain) it almost invariably causes nausea and vomiting, and great prostration. The larger doses also may cause diarrhœa, with muscular weakness and all signs of collapse—namely, weak and rapid pulse; cold, wet, and clammy extremities; slow, irregular breathing, and more or less rapidly developing signs of unconsciousness; it may give rise also to a blue colour of the face, convulsions, and death. As large doses of antimony are apt to be vomited, fatal poisoning does not often occur.

In medicine the use of tartar emetic has become more or less restricted. At one time it was very widely employed for a great variety of purposes, but at present it is used almost entirely as an emetic and diaphoretic, and as a relaxer of muscular spasms. Its use may be indicated in the acute stages of bronchitis and pneumonia; and it has a certain amount of value in the treatment of spasmodic croup, although it is doubtful whether there are

not other and less depressing remedies which can control the muscular action equally as well.

ANTIPYRINE.—A remedy which was introduced into medicine shortly after its discovery in 1883. It is a compound related to the alkaloids, and was first prepared from one of the aniline products. It has proved a very valuable remedy for the treatment of neuralgic pains and for spasmodic muscular conditions, as well as for the reduction of temperature. It is soluble in water, and has a very pronounced local action, blanching and drying the mucous membrane; and on account of this action it is widely employed with good effect in the treatment of colds in the nose, chronic coryza, and other affections of the nasal mucous membrane. Sprayed into the throat it is capable of overcoming the irritation of chronic sore throat, and of relieving the tickling and spasm of this type of affection. Taken internally in small doses it acts very quickly, causing in a short time a sense of quiet and restfulness due to general muscular relaxation. In doses of from 2 to 5 grains it causes these symptoms only, but in larger doses may bring about a depression of the heart-action and dilatation of the blood-vessels, leading to perspiration and a feeling of intense weakness and collapse. In still larger doses it may cause death from cardiac weakness.

In smaller doses antipyrine is very valuable in the treatment of severe headaches, and severe menstrual pains; and it is employed also to relieve the neuralgic pains of pleurisy, sciatica, tabes dorsalis, tic-douloureux, and similar affections. It is highly recommended in the beginning of acute affections, such as influenza, where general bodily distress is a prominent symptom; and it is also widely employed in conjunction with salicylate of soda to overcome the discomfort of acute articular rheumatism. Antipyrine is also very useful in conjunction with sleep-producing remedies, especially when slight pains are the cause of wakefulness. Taken internally it very frequently causes a rash on the skin which may be confused with that of scarlatina, measles, or even typhoid; it is therefore advisable not to use it if these diseases are suspected to be developing. Its use is not unattended with danger, and persons with weak hearts should not order the drug for themselves. Indeed, this whole class of drugs should never be self-prescribed, but taken only on the order of a physician.

ANTISEPTIC.—An agent used to diminish the growth of, or to destroy septic organisms. A better term is germicide. When it was realised that the germ theory of disease was more than a hypothesis, the importance of bacteria as disease-producing agents was greatly exaggerated, and the efforts made to destroy them, particularly outside of the body, were very much overdone. Now that students of pathology have demonstrated that the number of bacteria which are responsible for definite disease-processes are comparatively few, and a better knowledge has been gained of the modes by which they enter the body, the study of the different agents used

to destroy them has taken on a much more definite and enlightened aspect.

For purposes of medicine it may be said that antiseptics are divided into two large groups, those used for the destruction of germs outside the human body, and those used for the purpose of diminishing or destroying the germs that may be within the body itself. In the former class are included the large body of antiseptics used for disinfecting purposes, the most important of which are: (1) compounds of carbolic acid; (2) metallic salts, such as bichloride of mercury, copper sulphate, and salts of lead, zinc, and aluminium; and (3) compounds giving off free chlorine gas, such as Labarraque's solution, chlorinated lime, etc. For the general disinfection of rooms, houses, and open spaces gaseous antiseptics or disinfectants are employed, the most popular at the present time being formaldehyde gas.

In the disinfection of human excreta, which is so important in order to limit the spread of infectious diseases, such as typhoid fever, diphtheria, influenza, and tuberculosis, the use of antiseptics on the various secretions of the human body is very widely employed. Here, as in general disinfection, the best results are obtained from the carbolic acid series, from formaldehyde, and from the chlorine-discharging compounds. It is highly important that the fæces as well as the urine of patients suffering from typhoid fever should be treated with an antiseptic solution; and the sputum of the tuberculous, as well as the throat and nasal secretions of the diphtheritic, should be rendered as aseptic as possible.

The problem of internal antisepsis is not as simple as that which has just been considered. Here, again, at least two things should be borne in mind. Antisepsis of the intestinal, of the genito-urinary, or of the respiratory tract is essentially different from antisepsis of the cells within the body itself. From the standpoint of the anatomist, the respiratory, the intestinal, and the genito-urinary tracts may be technically considered as being outside of the body rather than within it. This is especially true for the intestinal; less so, perhaps, for the genito-urinary and respiratory tracts. Internal medication by means of the mouth is particularly efficacious in ridding the body of a number of micro-organisms which thrive in the intestinal canal, but so far as is now known very few of those organisms that can be reached by such means are responsible for any definite disease-process. Typhoid fever, for instance, although it manifests itself very largely through changes in the structure of the intestinal tract, cannot be considered a localised disease, but one involving the whole body; and attempts made to disinfect the intestinal tract with a view to overcoming the typhoid infection are unscientific and impractical. That some intestinal antiseptics may be of much service in limiting the amount of intestinal putrefaction and thus contributing to the comfort of the patient and aiding in the general treatment, there can be no doubt; but that the general disease will be modified thereby is unthinkable.

Much the same point of view may be held with regard to the respiratory and genito-urinary tracts. Antiseptic treatment of diseases of their organs has been popular in the past, and even now the giving of respiratory antiseptics is widely practised in the hope of averting the tuberculous process in the lung. It has not been demonstrated that it is possible to kill the tubercle-bacillus by any such means; and internal administration of creosote or of various aromatic oils, or the breathing of vapours charged with antiseptic substances, or the use of electrical devices to force medication into the lung proper are all ineffective so far as the tubercle-bacillus itself is concerned. It is known that much of the discomfort felt by consumptive patients is due, not so much to the ravages of the tubercle-bacillus itself as to the hordes of accessory parasites; and as has already been stated in regard to the intestinal tract, so here also the use of internal and external medication may alleviate in part at least the unpleasant consequences of these contributory factors.

Whether it is possible, in the present state of our knowledge, to say that there are any known remedies which can be introduced into the body and affect the bacteria, may be left an open question. There is no doubt that quinine, taken in sufficiently large doses, is capable of killing the malarial parasite which is found in the body; this parasite, however, is not one of the bacteria, but belongs to a group of animal organisms occupying a correspondingly low position in the animal scale. There is also sufficient evidence to justify one in saying that mercurial medication has a pronounced action on the cause of syphilis. What this cause may be is not yet definitely ascertained. Furthermore, there are a number of competent observers who hold that the use of salicylic acid and its related compounds is more than ordinarily efficacious in overcoming some bacterial infections of the joints, particularly acute articular rheumatism.

In intracellular antisepsis the great difficulty is that it is necessary to find an agent that can show a selective poisonous action on the intruding parasite, and no poisonous action on the cell-protoplasm. Inasmuch as the protoplasm of the human cells closely resembles that of many of the lower organisms, this problem has difficulties which only the trained observer can appreciate. But it has become more and more evident that selective poisons can be found, and the future opens up large promises in this interesting field.

It only remains in this article to mention some of the most widely used antiseptics, and to indicate in tabular form some of the general limits of their strength. In reading such a scale it should be remembered that the antiseptic power of any substance should be interpreted in the most general way. Every individual bacterium has its specific resistance, and what is true for it at one time may be different at another, so that the expression of a tabular summary of this type should be thought of in the general manner

indicated. The following table shows the disinfecting power of commonly used antiseptics, by indicating the minimum strength of their solutions necessary to permanently prevent the putrefaction of sewer-bacteria. For instance, 1:285 for potassium permanganate indicates that one part of potassium permanganate dissolved in 285 times its own volume of water has the strength needed for this purpose.

Acetic Acid	1:250	Formaldehyde	1:5,000
Alum	1:222	Hydrogen Peroxide	1:20,000
Aluminum Chloride	1:720	Iron Sulphate	1:90
Arsenious Acid	1:166	Mercury Bichloride	1:15,000
Boric Acid	1:143	Potassium Permanganate	1:285
Bromine	1:1,666	Silver Nitrate	1:12,000
Calcium Oxide	1:	Sulphuric Acid	1:800
Chlorinated Lime	1:	Zinc Chloride	1:500
Chlorine	1:4,000		

ANTITOXINS.—See Immunity.

ANUS, ARTIFICIAL.—When the patency of the intestinal canal has been interfered with by a malignant growth or a kinking of the gut so that the intestinal contents cannot be discharged through the anus, they will necessarily collect above the site of the obstruction. These waste products must be got rid of, however; and if it is impossible to remove the obstruction by operative or other means, an outlet for the fæces must be provided by the production of an artificial anus. In exceptional cases, a natural perforation of the gut may take place through the abdominal wall or other structures, and relief be thus afforded. Ordinarily, however, it is necessary to perform an operation, by which the abdominal wall is incised, and a loop of gut sutured into the wound, and then opened. On the timely production of such an artificial anus usually depends the success of the operation.

ANUS, FISSURE OF.—Term referring to a tear of the mucous membrane at the rectal opening. The act of defæcation becomes extremely painful as the discharge of the fæces necessarily stretches the opening and so irritates the sore place. The pain does not stop after the stool has been passed, but often continues for several hours, so that the patients suffer greatly from what is apparently an unimportant condition, and their work and manner of living may be seriously interfered with. Fissures of the anus may often be cured by a very simple procedure—namely, by stretching the muscle (the *sphincter ani*) which closes the anal opening and which, as the result of the constant irritation, is in a condition of almost continuous, painful spasm. In undertaking this operation, it is necessary that the patient be anæsthetised, and it should not be attempted without this aid.

APHASIA.—See Speech Disturbances.

APOPLECTIC STROKE.—See Brain, Apoplexy of.

APPENDICITIS.—Inflammation of he vermiform appendix. At the very tip of the cæcum, or blind pouch, situated at the beginning of the large intestine, there is located an organ which closely resembles in form and size

an ordinary earthworm, and which is known as the vermiform appendix (see Fig. 73). Inflammation of this organ is quite frequent, and gives rise to the disease known as appendicitis. The appendix is located in the lower portion of the abdomen on the right side. Its cavity is in the form of a narrow canal, and constitutes a favourite site for the deposit of bits of fæcal matter, which may become hardened and form the so-called "fæcal concretions" (see Plate XIII., Figs. 3, 4), and also of bacteria of various kinds.

FIG. 73. Cæcum and vermiform appendix, the wall of the abdomen being removed.

Occasionally foreign bodies, such as fragments of bone and fruit-pips, find their way into its lumen, and a warning should therefore be extended against accidentally swallowing these. The irritation resulting from the presence of this foreign material produces an inflammation of the mucous membrane, which becomes red and swollen ; and the condition is accompanied by fever, pain, and often nausea and vomiting. This is the most frequent and the simplest type of inflammation, and also apt to produce the least harm. It may come on suddenly in the midst of perfect health, or it may follow some indiscretion in diet, or long-continued constipation. If the disease runs an uncomplicated course, the initial violent symptoms disappear within three or four days. But if the fever remains high and the pulse rapid, then one has to deal with complications which are usually serious in character.

The ordinary type of catarrhal appendicitis may subside under medical treatment alone. The patient should remain in bed, on his back, and keep as quiet as possible. The diet should be exclusively fluid—milk, and soups ; small pieces of ice may be swallowed, and an ice-bag kept over the lower right portion of the abdomen. The medical treatment aims to relieve the pain and keep the intestines quiet, in order that the inflammatory process may not extend. After the disappearance of the fever, the patient should be kept in bed for at least another eight days under careful diet. Appendicitis belongs to that class of diseases in which recurrences are likely, and these are usually worse than the initial attack.

The second type of this disease is the purulent. This develops from the simple form just described, and sometimes on the first day. The suppurative process extends from the mucous membrane to the muscular wall of the appendix and then rapidly invades the peritoneum, from which results a circumscribed peritonitis. It is the generalisation of the latter which causes the great danger in appendicitis. At first the purulent focus may not be larger than a hazel-nut, and separated from its surroundings by newly-formed inflammatory adhesions, which prevent the rupture and consequent spreading of the pus through the general peritoneal cavity. The more extensive the abscess, and the longer it is present, the greater the danger of a general peritonitis. It is essential, therefore, to provide as soon as possible for an evacuation of this focus of infection. This can be accomplished only by the knife of the surgeon, as the absorption or evacuation of the pus through the medium of the gut is so rare an occurrence that no reliance should be placed thereon. If the rupture of the abscess into the free peritoneal cavity occurs, the latter becomes filled with the pus, and surgical interference is too late to do much good. For this reason every case of appendicitis needs careful watching by the physician from the very beginning, as a change for the worse may take place at any time.

The third form of appendicitis is the gangrenous, and this is the most dangerous. Perforation of the gangrenous tip of the appendix may take place during the first day of the disease ; the patient rapidly gets worse, the condition ending fatally within two or three days. The severe symptoms which accompany this type of the trouble are continued high fever, severe vomiting, marked abdominal distension, coma, etc.

Unfortunately it is not always possible to determine just what form of inflammation is present in the appendix, nor what course the disease will take. For these reasons many surgeons claim that every case of appendicitis should be operated for at the first evidences of trouble. This extreme view, however, is not universally adopted because careful statistics have shown that at least 75 per cent. of all patients with appendicitis get well after the first attack. Recurrences of the attacks, which may come on during succeeding years, make the prognosis for complete cure somewhat

more unfavourable, because small foci of pus or adhesions to surrounding structures may remain. In such cases, the patient may well be advised to have an operation performed during the interval between the attacks when neither pain nor fever is present. The operation is then less dangerous and the results more certain, especially if the appendix, which is the cause of all the trouble, is entirely removed. This organ may readily be spared by the body, as it possesses no known value.

APPETITE, LOSS OF.—A frequent accompaniment of various digestive disturbances, especially of gastric complaints. It depends on a weakened or insufficient amount of the digestive fluids, particularly of the hydrochloric acid in the stomach. The tongue loses its normal moist appearance; it becomes dry, and is coated with the accumulation of the cells cast off from its upper surface. As a general thing the condition of the tongue forms a fairly safe indication of the condition of the stomach, but in some cases even the most obstinate and serious gastric illness may cause little or no change in the appearance of the tongue. Loss of appetite alone does not constitute an absolute criterion of the extent or nature of a disease. It may be present in very slight digestive disturbances and absent in the most serious. In conclusion, attention must be called to the loss of appetite, which is a purely nervous condition and which may be recognised only with the greatest difficulty by the physician.

APRAXIA.—See Speech Disturbances.

ARNICA.—The dried flower-heads and dried roots of *Arnica montana*, a plant native to Europe, grown extensively in Germany and Switzerland, and sparingly found cultivated in the United States. It contains an active volatile oil which is largely responsible for its physical effects. The principle, *arnicine*, is also described, but is imperfectly known. Applied to the skin, arnica causes irritation, and if the application is permitted to continue it may cause inflammation of the skin, with the formation of blisters. Taken internally it stimulates the mucous membrane of the mouth, œsophagus, and stomach, and may act as a bitter, improving the appetite. It acts like others of the volatile oils, causing a reflex stimulation of the heart-beat, dilatation of the blood-vessels of the surface of the body, increased flow of perspiration, and also increased flow of urine. In large doses it may cause symptoms of burning in the mouth and stomach, nausea, vomiting, intense prostration, with dilated pupils and rapid, feeble heart, cold extremities, occasional convulsions, irritation of the kidneys, and death from exhaustion. Liniments containing arnica are in wide favour with the laity, but it is highly improbable that they have any specific action beyond their mild counter-irritant effects. The alcohol in many of these liniments is probably an important adjunct in explaining the therapeutic results obtained. Arnica is too dangerous a drug to be employed to any great extent for internal medication.

ARSENIC-POISONING AND ARSENIC EATERS. Arsenic-poisoning may result from swallowing the white arsenic in the form of rat-poison, or from eating the meat of animals which have become poisoned by this means. It may also be caused by the ingestion of various colours containing the poison, or by inhalation of dust from substances containing arsenic for colouring purposes, as clothes, toys, wall-paper, candles, etc. The effects may come on immediately after the material has been swallowed, and consist of severe vomiting, cramps in the muscles of the legs, general prostration, unconsciousness, and convulsions, which may end fatally. In place of this a chronic poisoning may result, which may also occur from continued ingestion of small quantities for a prolonged period. The latter form is seen also in persons who are occupied with arsenic preparations, or who live in rooms which are papered or painted with materials containing arsenic. An epidemic of arsenic-poisoning a few years ago came from beer, in the preparation of which arsenic had been carried over into the glucose.

The chronic type of arsenic-poisoning can be recognised only by the physician, and the most marked symptoms are the poor general condition and the pale, emaciated appearance of the subjects. Other symptoms are: diarrhœa; vomiting after meals; large, brown, scaly patches in the face; the flexor aspect of the limbs, the palms of the hands, and on the soles of the feet; and tremor and paralysis. In some cases the nails and the hair fall out. A chronic cold in the head with puffiness beneath the lower eyelids is very characteristic.

In acute poisoning, emetics should be given at once, followed by lime-water with milk or the white of eggs. The medicinal antidote to be administered by the physician is a mixture of iron (the hydrated ferric oxide) and magnesia. In cases of chronic poisoning the source must be removed, and for the remaining treatment a physician had best be consulted.

In certain mountainous districts of Europe, as in the Tyrol, there are persons in the habit of taking small quantities of arsenic regularly several times a week in order to improve their appearance, and, as they claim, to enable them to bear more readily the fatigue of climbing. The habit is not considered harmful; yet the sudden cessation of arsenic-eating is followed by the appearance of various symptoms of illness. See Poisoning.

ARTERIES.—The vessels of the body that carry arterial blood, or blood after it has left the lungs and become oxygenated. The name signifies "air vessels," and was given to these vessels at a time when, because they were always observed to be empty, they were thought to be carriers of air, or "vital spirits." For a knowledge of their distribution and structure consult the article on The Circulatory System (pp. 152–157).

ARTERIES, DISEASES OF.—A number of types of disease are found in the arteries. The most important are: *Arteriosclerosis,* due to old age; *Arteritis,* due to infections by micro-organisms, notably syphilis and tuber-

culosis; and *Aneurism*, due to dilatation caused by mechanical defects which may depend upon the two former factors.

Arteriosclerosis is a change in the character of the arteries, and consists in a gradual thickening of their walls, with or without a deposit of lime. This disease usually accompanies old age, although occasionally found in the young. It interferes with the normal elasticity of the vessels; the arteries, especially those of the wrist and temple, present a hard and wiry feel to the touch, and their course becomes more or less tortuous, while their pulsations may be visible to the eye. The thickening or calcification may develop early in life by severe bodily labour, by the excessive use of alcohol or tobacco, by a luxurious life without sufficient exercise, by syphilis, gout, and obesity, and by a number of other causes. As a result of this condition there often results enlargement of the heart, congestion, and impaired circulation of blood in the abdominal vessels, and with this, indigestion, constipation, and the formation of hæmorrhoids, the last-named often appearing as forerunners of the trouble in the vessels. If, as the consequence of such calcification, the circulation in the coronary arteries is interfered with, there follows a disturbance of the heart-action, palpitation, vertigo, fainting, bronchitis, and, under certain circumstances, marked evidences of cardiac weakness. Cerebral hæmorrhage may also take place.

Many of these consequences may be avoided or postponed by timely medical treatment. Persons who lead a luxurious life and are inclined to obesity, should be advised to take proper and sufficient bodily exercise, and to eat and drink in moderation, taking little meat, but plenty of milk, vegetables, and starchy foods. Spices, coffee, tea, alcohol, and tobacco should be avoided as much as possible, or, better still, entirely prohibited. Moreover, severe bodily and mental exertion and sexual indulgences are also harmful to these patients. Cold sponging and rubbing of the upper part of the body are to be recommended, but a warning should be given against the extremes of heat or cold in bathing. Daily evacuations may be aided by taking fresh or dried fruit, enemas, and mild cathartics when necessary. For climatic and other cures, see HEART, DISEASES OF.

Arteritis is an acute affection of the blood-vessels of the body, due to infection by micro-organisms. It is an affection seen most commonly in the acute articular rheumatic infections, and in typhoid fever.

Aneurism.—See special article on this disease.

ARTHRITIS.—An acute or chronic inflammatory reaction in a joint, due chiefly to bacterial infection, to altered trophic conditions, or to disturbances in the chemism of the structures of the joint. The arthritides due to the bacteria are, principally, acute articular rheumatism (see RHEUMATISM); gonorrhœal arthritis (see GONORRHŒA); typhoid arthritis, and tuberculous arthritis. The arthritis of locomotor ataxia (Charcot joint) is thought to be due to trophic disturbances dependent on degeneration of

the peripheral sensory neurones; while the arthritis of GOUT (which see) is thought to be related in some manner with altered chemism of the body or joint-structures. Consult ARTHRITIS DEFORMANS; JOINTS, DISEASES OF; NEURITIS; RHEUMATISM.

ARTHRITIS DEFORMANS.—Deforming inflammation of the joints. It is still an open question whether this affection is an individual disease, or whether it is a variety of chronic articular rheumatism. It is distinguished from the latter in that the affected joints, as is implied by the name, are "deformed," considerable growths of the bones changing the form of the joints. The deformity is still more intensified in that the muscles surrounding the joint become thinner and gradually waste from disuse. Otherwise the symptoms of the disease are almost the same (pain and stiffness of the joints) as in articular rheumatism, which may persist for years. The affection occurs most frequently in middle-aged and elderly persons, but it has also been observed in young people and in children. It has no connection whatever with gout. Women are more frequently affected than men.

The disease begins with pains in the joints, occurring principally during exercise, and subsiding during rest, and with disagreeable stiffness of the joints, most marked after rest (for instance, after rising in the morning). These disturbances are soon followed by a continually increasing restriction of movability, and by a visible alteration of the affected joints. The disease involves either one joint only (for instance, the hip-joint) or, as is usually the case, several joints (those of the fingers, hands, vertebræ, etc.). The disease operates in such a manner that the corresponding joints of both halves of the body become affected, although usually the joints of one side are more markedly affected than those of the other. The joints of the fingers are most frequently attacked, resulting in a peculiar attitude of the hand. The fingers are slightly curved, held obliquely toward the side of the little finger, and imbricated; the joints between the fingers and the bones of the middle hand are swollen and thickened (see Fig. 74). As the thumb remains fairly movable, a great many patients are still able, in spite of the stiffness of the fingers, to accomplish finer work with their hands (for instance, writing and needlework). Similar, but not quite as marked, are the changes in other parts of the body. Other morbid disturbances, apart from wasting of the muscles, are not observed.

Although the affection persists for a long time, the patient should not become despondent. There occur cessations, even improvements, and it is possible, with proper treatment and good care, to render life endurable even in severe cases, and often to achieve satisfactory results. The treatment is, upon the whole, the same as that of chronic articular RHEUMATISM (which see).

ARTIFICIAL RESPIRATION.—Respiration produced by mechanical means. To perform artificial respiration the tongue should be grasped

with a handkerchief or towel, held between the thumb and index-finger, and pulled out beyond the line of the teeth. With the other hand pressure is made over the abdomen in the notch between the ribs, toward the diaphragm, at regular intervals, about 25–30 times to the minute. By means

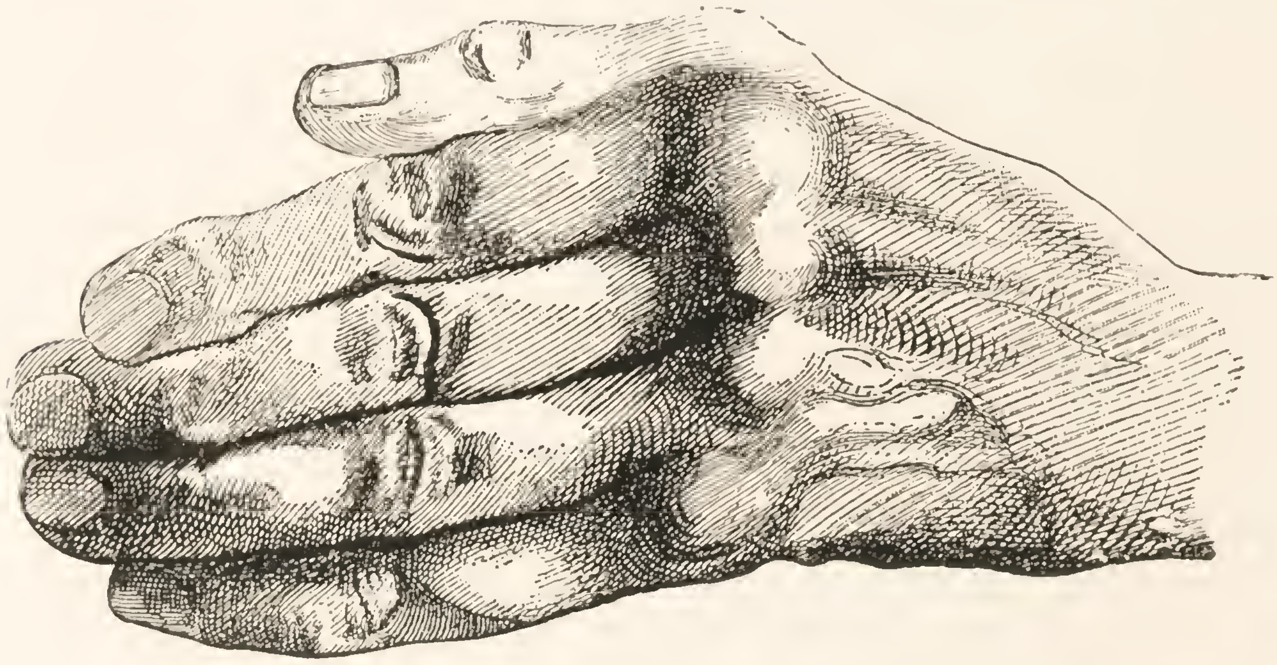


FIG. 74. Position of fingers in advanced rheumatoid arthritis.

of this alternating compression and relaxation, the lungs are made to contract or expand. If an assistant is present, he should be directed to extend both the patient's arms fully over the head and then to bring them down along the chest and press them tightly against the body (see Figs. 75, 76, 77).

FIG. 75. Sylvester's method for artificial respiration (inspiration).

The elevation must correspond in time with the relaxation of the pressure on the abdomen, and the depression of the arms with the compression on the latter (Sylvester's method).

Howard's method is especially valuable in apparent death from drowning. The body of the subject is bared to the waist and the clothes rolled

up into a tight bundle which is placed under the stomach of the patient who is stretched out prone on the ground (see Fig. 78). The person may also be placed over the knee and the head held with the hand as shown in Fig. 79. The tongue thus drops forward and pressure on the

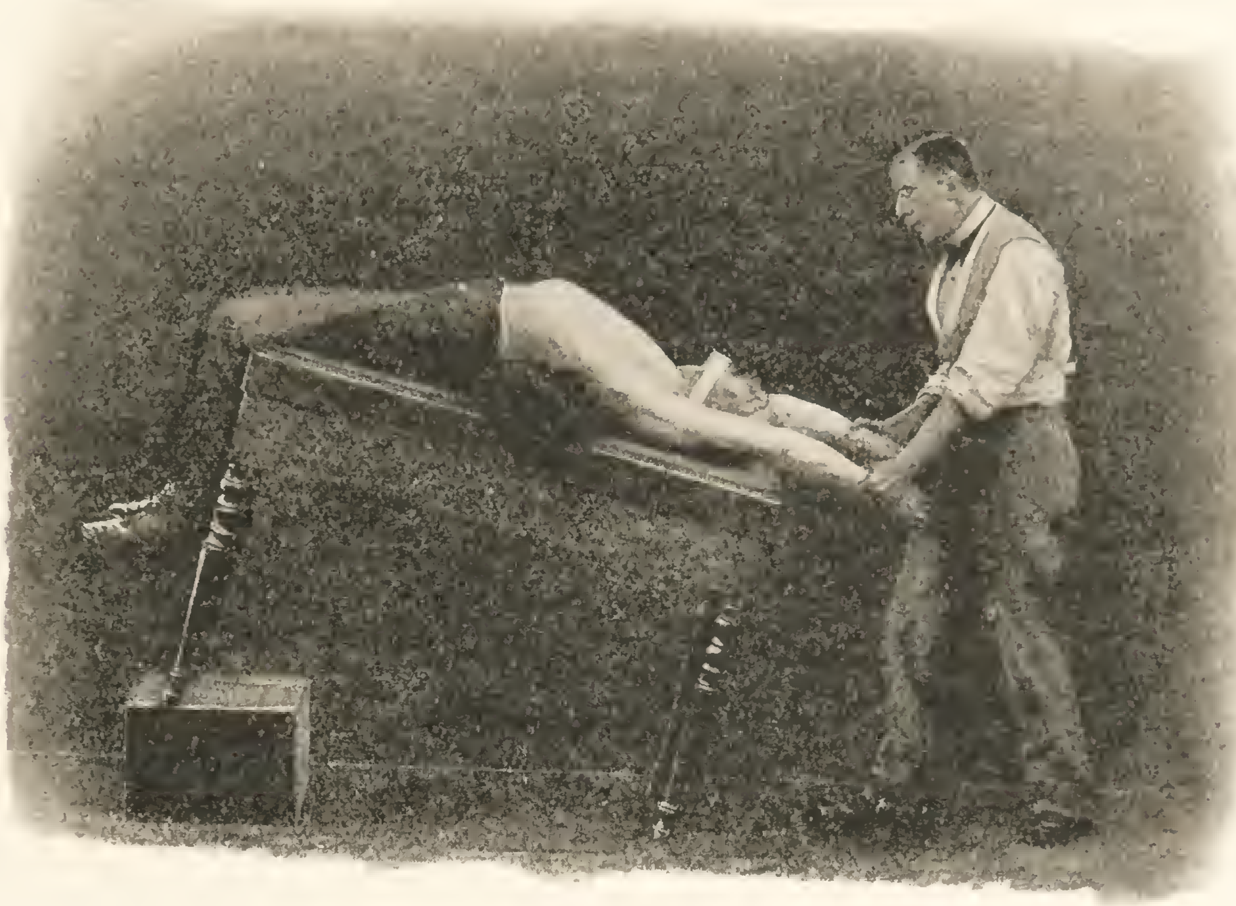


FIG. 76. Sylvester's method for artificial respiration: 1. Raising of the arms (inspiration).

FIG. 77. Sylvester's method for artificial respiration: 2. Folding the arms (expiration).

back favours the outflow of the water through the mouth and nose. The subject is then placed on his back and the tongue drawn out at the angle of the mouth, preferably on the right side, and held there by an assistant who may grasp it with a towel held between his index-finger and thumb. The

bundle of clothes remains under the back so that the region of the stomach is directly elevated. The operator then kneels down alongside the patient, or assumes a straddling position over the hips (Fig. 80), placing both hands on the chest so that the thumbs are directed toward the intercostal

Fig. 78. Artificial respiration by Howard's method.

notch and the palms extend around the lower part of the thorax (Fig. 81). In this position the operator exerts on the subject's chest a steady pressure which may be aided by leaning over and resting the weight of the body on

Fig. 79. Artificial respiration by Howard's method.

the hands (Fig. 81). The operator counts to three, then releases the pressure suddenly; again counts to two, and renews the pressure. This must be continued until the person breathes without artificial aid.

Artificial respiration is useful in the treatment of many poisoning

accidents, as by opium, morphine, alcohol, coal-tar products (headache- and menstruation-powders), etc. It is imperative in the treatment of drowning. See Asphyxia; Drowning. Consult also the paragraph on Respiration in Introductory Chapters (pp. 144–145).

ASAFŒTIDA.—A gum resin obtained from an eastern plant, *Ferula fœtida,* and from other closely allied species. Many of the plants which

Fig. 80. Artificial respiration by Howard's method.

yield the gum resin are natives of Persia and some of the Russian provinces, Afghanistan, etc. The active principles of asafœtida are volatile oils and gum resins, ferulic acid being one of the most important constituents. This body is closely allied to the volatile oil of cinnamon. Asafœtida has a very disagreeable taste and odour, and is used largely as an antispasmodic. It stimulates the intestines to increased peristaltic action, and is capable of

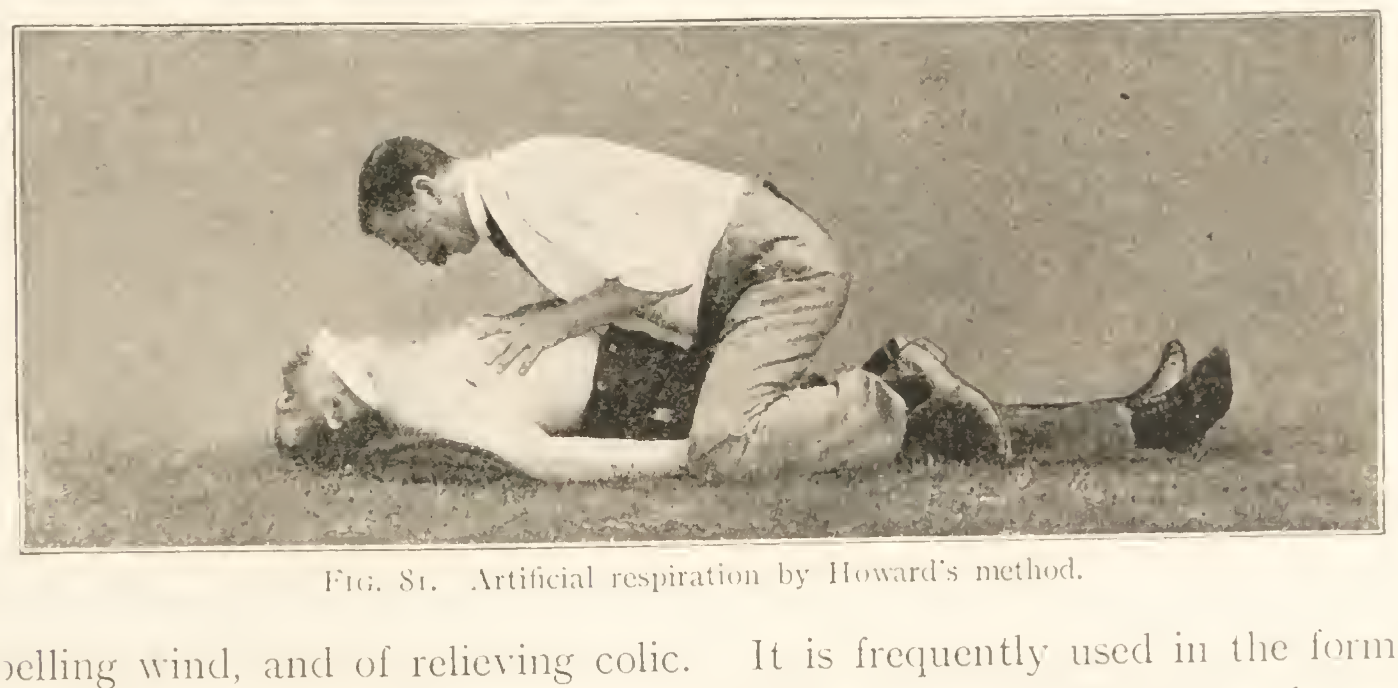


Fig. 81. Artificial respiration by Howard's method.

expelling wind, and of relieving colic. It is frequently used in the form of enemas to expel flatus, and is highly effective. As it stimulates the vaso-motor system and the sympathetic nervous system throughout the whole body, it has been thought of much service in the treatment of depressed states of the sympathetic nervous system, notably in hysteria. It is usually employed in doses of three to five to ten grains in the form of pill or emulsion.

ASARUM (WILD GINGER).—The root of *Asarum Canadense*, a very widely distributed herb found in the eastern part of the United States and Canada. Its active principle is a volatile oil which is very sharp and biting, causing a feeling of warmth in the stomach and increasing the appetite. It is frequently used in small doses as an adjuvant to other aromatic bitters.

ASCITES.—Term applied to the accumulation of free fluid in a serous cavity, particularly the abdominal cavity. The cavity is more or less distended depending on the quantity of fluid present, and when the prone position is assumed the flanks are seen to bulge. Where the collection of fluid becomes considerable in amount, the skin of the abdomen is smooth, shiny, and striated. This condition may be caused by localised peritoneal inflammations, acute or chronic ; by congestion in the portal circulation from hepatic disease (cirrhosis of the liver) ; or as part of a general ascites which appears in the presence of heart or kidney difficulties and various chronic illnesses. If the ailment is due to inflammatory processes in the peritoneum, there is usually present great pain in the lower portion of the abdomen, irregular fever, occasional vomiting, irregular bowel conditions, and frequent desire to urinate. The abdomen may also be distended by the accumulation of gas in the intestine, by ovarian tumours, etc. A careful medical examination is therefore necessary to determine the cause of the trouble, and eventually an operation is indicated in most instances in order to save life.

ASCLEPIAS (PLEURISY ROOT).—The dried root of *Asclepias tuberosa*, a handsome, orange-coloured milkweed growing in sandy soil throughout the northern portion of North America. Its active principle is thought to be a glycosid, *asclepiadin*, the action of which is similar to that of digitalis (which see), although much less pronounced. It is a heart-tonic, a diuretic, and a contractor of the blood-vessels ; but it has no particular value as a remedy for pleurisy, notwithstanding its popular name. Its chief use is to increase the flow of urine in some cases of heart-disease.

ASPHYXIA.—Partial or complete unconsciousness due to an insufficient supply of oxygen in the blood. The condition may result suddenly, as in drawing food into the windpipe (in choking) ; by being immersed in water (in drowning) ; by pressure on the lungs (in pleurisy) ; or by insufficient lung space to oxidise the blood (in simple or tuberculous pneumonia). It may result from the taking of large doses of certain drugs, notably those that in breaking down in the body liberate paramidophenol ; particularly acetanilid (found in most headache-powders) and phenacetin. It may occur also in acute alcoholism, or acute opium poisoning. It may develop as a chronic condition in many heart-diseases, and in poisoning by gas or other poisons, notably the anilines. The chief symptoms and treatment are described under DROWNING, and POISONING.

ASPIDIUM (MALE-FERN).—The dried rhizome of *Aspidium Filix-mas* or of *Aspidium marginalis*, two ferns more or less widely distributed throughout the world. The former is found fairly extensively throughout the world; the latter is common to Canada and the United States. The active principle is not thoroughly known, filicic acid and several closely allied compounds being thought to be the most important constituents. The action of aspidium is unique. It has the property of killing tapeworms, which it does fairly rapidly and very effectively. The drug is rarely absorbed, as it has some irritating properties causing mild catharsis, but if absorbed, and in comparatively large quantities, symptoms of poisoning may develop. The most important of these are convulsions, accompanied by intestinal irritation, pain, vomiting, purging, relaxation, etc. An uncommon accompaniment of the poisoning is a more or less permanent partial or complete blindness. The drug is used as a rule in the form of an oleoresin in doses of one-half to one teaspoonful.

ASSIMILATION.—See under Organs of Digestion in Introductory Chapters (pp. 145–150).

ASTHENOPIA.—See Sight, Disturbances of.

ASTHMA.—A disease characterised by a peculiar form of shortness of breath or dyspnœa, and due usually to the sudden contraction of the smaller bronchi. The most frequent cause for this contraction of a passage which is none too wide at best is a swelling of the mucous membranes which line the interior of the bronchi; in other cases it is brought about by a spasmodic contraction of the muscular fibres which encircle the air-passages in the lungs.

Attacks of asthma may be incurred by the sudden aggravation of a chronic bronchial catarrh, by a disease in the interior of the nose, or by purely nervous influences, such as the odour of violets or burnt coffee. In some cases the attack appears without warning; in others it may be preceded by certain preliminary symptoms, as a general sense of unrest, frequent yawning and sneezing, or peculiar sensations in the regions of the stomach and the larynx. The patient may be awakened from a sound sleep with a feeling of oppression and shortness of breath. He thinks he is suffocating, sits up in bed or rushes around the room gasping for air, supports himself with his arms on the edge of the table or the window-sill, and even throws open the window in order to get as much fresh air as possible. Breathing is superficial and accompanied by a loud whistling or rasping tone, which is distinctly audible at some distance from the patient. The facial expression is the picture of fear and unrest, the skin assumes a bluish tinge because the blood is not being oxidised, and a cold sweat breaks out over the whole body. In the course of one or two hours the attack passes away, during which time a greater or less amount of tough, tenacious mucus is expectorated. In some instances the condition may be prolonged

over several days and even weeks, in which there are alternating periods of improvements.

Persons from 20 to 40 years of age are ordinarily affected. Whether the first attack will remain the only one, or whether it will be repeated at stated or irregular intervals, it is impossible to know in advance. If the condition is due to disease of the interior of the nose, to swelling of the turbinate bones, to polypus, or to chronic catarrhs, correction of the primary disease will usually result in a permanent disappearance of the asthma. But even in such cases it is well not to place too much faith in an absolute cure.

Sufferers from asthma should provide themselves with, and have constantly on hand, a supply of those remedies which they have found by experience to furnish them with relief. Of the numerous remedies which have been suggested, the following may be mentioned: mustard in the form of a paste applied to the chest; immersion of the hands or the feet in hot water; the smoking of cigarettes made from stramonium-leaves, sage, or tobacco; and inhalation of the fumes of burning paper which is impregnated with a half-saturated solution of saltpetre. In severe cases the use of more efficient drugs may be necessary, but their administration should be left to the discretion of the physician. A great deal of good may be obtained also from measures directed to improving the general condition of the system, among which hydropathic and climatic cures deserve especial consideration. When the asthmatic condition is due to pulmonary emphysema, whereby the lung becomes less resilient than in health, on account of the diminished elasticity of the air cells, the contrivance known as "Rosbach's Chair" may often be used with success.

ASTRINGENTS.—Agents that, when locally applied to mucous membranes, have the power of coagulating albumen, of precipitating proteids, and of affecting the vessels and secretions. Vegetable and mineral astringents are widely employed, the former owing their activity to tannic acid. The mineral astringents are numerous. The most important are lead acetate, copper sulphate, zinc sulphate, silver nitrate, and salts of aluminium (alum). The animal extract of the suprarenal glands has an action markedly similar to the astringents on the blood-vessels and secretions. Astringents are used mostly to limit excessive production of mucus; and they are widely employed in cold in the head, in leucorrhœa, and in the preparation of gargles for sore throat, etc.

ATAXIA.—A word generally used to indicate the loss of ability to control muscular movements. Such inability is very frequently a symptom of a number of nervous disorders, both of an acute and of a chronic nature, and may even be present in a number of other illnesses; it is not infrequently the sign of some forms of poisoning, notably alcoholism, mercurial poisoning, etc.

Ataxia may show itself in a great variety of forms. At times it may be slight, as is seen in mild trembling and loss of muscular control due to weakness occurring as a result of any acute illness. It may be very mild, as seen in the staggering gait of the semi-intoxicated man; or it may be very profound, as in diseases of the nervous system, more particularly in LOCOMOTOR ATAXIA, in multiple sclerosis, in general paresis, and in tumours of the cord or brain, particularly in cerebellar tumours. In these more severe grades the ataxia may involve a large number of muscles. Not only the lower limbs are impaired, but also the arms are incapable of control. Thus a number of individuals suffering from any of these diseases are unable to button their clothing without difficulty; they frequently cannot walk without a cane; and involvement of the muscles of the mouth and tongue causes indistinctness, or even loss of speech. The cause of the ataxia is difficult to determine, as muscular co-ordination is a complex process; but in nearly all cases in which profound ataxia is observed there is usually either an interference with the sensory portion of the nervous arc, or some process that interrupts the passage of continuous motor impulses from the brain.

When coming on gradually, ataxia is almost invariably a very grave symptom of some disorder of the nervous system, and expert advice should be sought at the time when the earliest signs of the disease appear.

ATHETOSIS.—An irregular rhythmic movement of the arms, hands, or body, usually following an injury to the brain-substance, either in the motor cortex, or in the motor conduction paths. It most frequently follows hemiplegic affections, either as a result of cerebral hæmorrhage, thrombosis, or embolism.

ATROPINE.—An alkaloid found in many plants of the *Solanaceæ*; principally, however, in the belladonna plant, *Atropa Belladonna*, or deadly nightshade. See BELLADONNA.

AUDITORY CANAL—See EAR.

AUDITORY NERVE.—The eighth cranial nerve is the nerve of hearing, and probably acts also as a nerve of the sense of equilibrium. It arises from nerve-cells situated in two parts of the internal ear, and from which fibres collect to form the vestibular and cochlear branches, which, uniting, form the auditory nerve. The vestibular branch originates in the nerve-cells of the semicircular canals (see ANATOMY OF THE EAR, in INTRODUCTORY CHAPTERS, pp. 162–164), and is largely concerned with the senses of equilibrium and position of the body. The cochlear branch arises from the ganglion cells of the organ of Corti, and conveys the sound-impressions from the organ to the brain. After uniting, the two branches run in the internal meatus of the auditory canal, lying in close contact with the seventh, or facial, nerve. The cochlear nerves then enter the medulla, and their first auditory neuron ends about cells in the superior olive and trapezium.

A continuation of the neurons enters the fillet, and terminates about cells in the auditory centres in the second temporal convolution. Any lesion in the first neuron causes ordinary deafness, while lesions of the second neuron bring about auditory aphasia. See BRAIN, DISEASES OF. The vestibular branches end in the nuclei of Deiters and Bechterew in the medulla, and then pass into the cerebellum. Involvement here causes a form of cerebellar ataxia.

AURA.—A peculiar sense which often precedes an attack of epilepsy. It conveys the sensation either of suffocation, of a rushing of blood up the body, of prickling and numbing, of a headache, or of dizziness. See EPILEPSY.

AURICLES.—See HEART; also THE CIRCULATORY SYSTEM in INTRODUCTORY CHAPTERS (pp. 152–157).

AUSCULTATION.—A method of examining the large body cavities, notably those of the chest and abdomen, by judging from the sounds that they convey to the ear. Laennec was one of the first physicians to develop to any degree of perfection this method of examination, although Hippocrates, the father of Greek medicine (400 B.C.), employed the naked ear. The examiner may use either the naked ear over the chest or heart, to determine the functions, or he may use an instrument by which the sounds may be the more readily and forcibly conveyed to his ears. Such instruments are known as stethoscopes, phonendoscopes, etc.

AUTO-INTOXICATION (SELF-POISONING).—A type of poisoning which may take place in the body of an animal or a plant as a result of its own metabolism. In all plant and animal growths, certain products appear which, unless modified, would poison the plant or animal. Thus, in all plants oxalic acid is formed as a necessary step in the building up of starches and sugars. The plant protects itself from poisoning by neutralising this acid with calcium salts, forming insoluble calcium oxalate crystals. The human body protects itself constantly in a variety of similar ways. Thus, in the very act of breathing, when the oxygen of the air enters the red blood-cells, the carbon dioxide formed by the oxidation in the tissues is eliminated, and life is made possible.

As a result of tissue metabolism many acids (sulphuric, acetic, etc.) are formed in the human body; and these acids, if not neutralised and eliminated, as in the urine, would give rise to poisoning. The liver is a very active organ in looking after the necessary oxidations and reductions in the human body; and it is largely due to the integrity of this organ that auto-intoxication does not more readily occur. There are few really well-known examples of true auto-intoxication in man; and the countless cases described by quacks and charlatans are for the most part pure nonsense.

Among the diseases that are thought to bear a close relationship to auto-intoxication are the following: (1) Those caused by the failure of chemical

function of some organ, as the pancreas (in *bronze diabetes*); the thyroid gland (in *myxœdema*; *cretinism*; *exophthalmic goitre* (?)); the pituitary body (in *acromegaly*); and the blood-making organs (in *pernicious anæmia*). (2) A second group result from imperfect combustion and elimination. Diabetes is an illustration. Gout may be another. (3) Retention of a product produced in a true physiological process, as in carbon dioxide poisoning in heart affections. (4) Excessive production of poisons, with insufficient neutralising powers, as in the acid intoxication of diabetes in which all the alkalies of the body are utilised to overcome the excessive amounts of organic acids formed. Other factors are at work, but those enumerated are sufficient to indicate the general subject. Poisoning from constipated retention of fæcal products is not here concerned. This is really a poisoning caused by agents outside of the body.

AUTOPSY.—The examination of a dead body in order to determine more minutely and more accurately the causes of death. The public should insist on having autopsies performed on all dead bodies, such examinations being of service to the people at large by affording physicians the opportunities for studying diseases more closely.

AUTO-SUGGESTION.—See SUGGESTION.

B

BACILLI.—See BACTERIA.

BACTERIA.—Name given to a class of simple plants, the relation of which to disease processes has become of immense importance. Bacteria are exceedingly minute, one-celled plants, often less than $\frac{1}{25000}$ of an inch in diameter; they have no green colouring matter (*chlorophyl*) like higher plants, and they grow by a process of splitting. In the plant scale they are grouped with fungi, and they belong among the very lowest members, being intermediate or transitional algæ which have become parasitic.

With regard to shape, three main groups of bacteria are distinguished: (1) *Coccaceæ* (spherical forms), micrococcus, diplococcus, streptococcus, staphylococcus, and sarcina being the names of the genera; (2) *Bacteriaceæ* (rod-shaped forms), divided into bacillus (with flagella) and bacterium (without flagella); and (3) *Spirilla* (spiral forms). Other forms are known, but with regard to these a reference to some text-books on the subject may suffice (see Migula, *System der Bakterien*; Kolle und Wassermann, *Handbuch der Pathogenen Mikroorganismen*; Muir and Ritchie, *Bacteriology*).

The properties that are of prime importance in the bacteria are connected with their life history. In their struggle for existence they have elaborated a number of chemical substances (ptomaines, toxins, etc.) which act as poisons on the human body, destroying it by causing complex changes in many of the vital organs. The changes that may be induced

by these bacteria and by their poisons are numerous, and the large subject of bacterial pathology cannot be here considered ; as a rule, however, they either cause slight changes in the blood so as to render it incapable of carrying on its functions, or their poisons so affect the nervous centres that they cannot keep up their activities.

Most bacteria cannot live in the human body and hence play no part in disease. Many cause diseases in lower animals ; and bacterial diseases of plants are responsible for the loss of millions of pounds every year to the farmer. Bacteria are essential in the breaking down of organic tissues, reducing the complex chemical structures to simple compounds that may be used by plants. They are invaluable in thus completing the circle of balance between plant and animal life. See CAUSES OF DISEASE in INTRODUCTORY CHAPTERS (pp. 173-177).

BALANITIS.—An inflammation of the mucous membrane of the prepuce ; usually caused by uncleanliness. The secretion (*smegma*) which is normally present in this region decomposes if not regularly removed, and thus irritates the surface of the glans penis, the groove at the back of this, and the inner aspect of the foreskin. The mucous membrane becomes more or less sore, and gives off a thin, foul-smelling, purulent secretion. Bacteria from without may also be a factor in producing this condition, or it may be due to sexual intercourse. The trouble begins with an intense itching of the affected parts, and this is followed by the appearance of the purulent secretion, which stains the linen. If neglected, this may lead to swelling of the foreskin and bring about a narrowing known as *paraphimosis*. The condition may be complicated by inflammation of the lymphatics and of the nearest glands. The disease is very often seen in small boys ; and if any inflammation of the penis is complained of, this condition should always be suspected. It is deserving of especial attention because the irritation produced is often the means of inducing masturbation in the affected child.

The best preventatives against this otherwise harmless disease are extreme cleanliness of the parts, regular washing with the foreskin retracted, and the application of a dusting-powder to maintain dryness. If suppuration is present, the patient should be kept quiet, and cooling lotions applied ; if the foreskin cannot be easily retracted, cold applications and irrigation of the preputial sac with lukewarm water are to be employed. If there is persistent contraction of the preputial opening, the physician had better be consulted in order to avoid subsequent annoyance and possible confusion with other and more important diseases. In the absence of complications, the condition itself is of little importance and usually subsides under the influence of the simple measures mentioned. Certain practitioners make much of a simple case of balanitis, usually telling boys that they have contracted a severe venereal disease. The family physician should always be consulted.

BALDNESS.—See Hair, Care of.

BALSAM OF PERU.—A balsam obtained from the *Toluifera Pereiræ*, a handsome, tall tree found in tropical countries, and chiefly utilised in San Salvador. It contains volatile oils and resins, as well as compounds of cinnamic and benzoic acids, to which many of its properties are due. It is much employed externally in the treatment of wounds, indolent ulcers, and in suppurative conditions of long standing in which stimulation of granulation-tissue is important. It is of service also in itching conditions of the skin, such as scabies, etc. Internally, given well diluted, it may be of service in chronic inflammations of the mucous membrane of the genito-urinary and respiratory tracts. It is rarely given in more than five to ten grain doses.

BALSAM OF TOLU.—A balsam obtained from the *Toluifera balsamum*, a tall tree of Venezuela and neighbouring countries. It has many of the properties of balsam of Peru, but being milder and less irritating than the latter it is used more widely in internal medicine.

Fig. 82. Various forms of bandages.

BANDAGES.—Surgery employs various kinds of bandages, namely, cloth, linen, adhesive plaister, plaster of Paris, and water-glass bandages. Skill in making these bandages is sooner acquired by practice than from illustrations. It is important for the layman to know how to make linen bandages, for they are easily applied, and are useful in urgent cases. Illustrations of some of these with directions for applying them are therefore given.

Bandage to the eye (Fig. 82, *a*). A folded cloth to cover the sick eye; another bandage drawn across the forehead and tied around the back of the head, thus keeping the first cloth in a secure position.

A split bandage for the nose is illustrated in Fig. 83. The lower ends are drawn above the ears, the upper ends below the ears and back to the nape of the neck where they are tied together. The same kind of bandage for the forehead and head is shown in Fig. 84.

Sling for the arm (Fig. 82, *b*). Take an unfolded three-cornered cloth; put one corner on the shoulder of the arm which is to be supported,

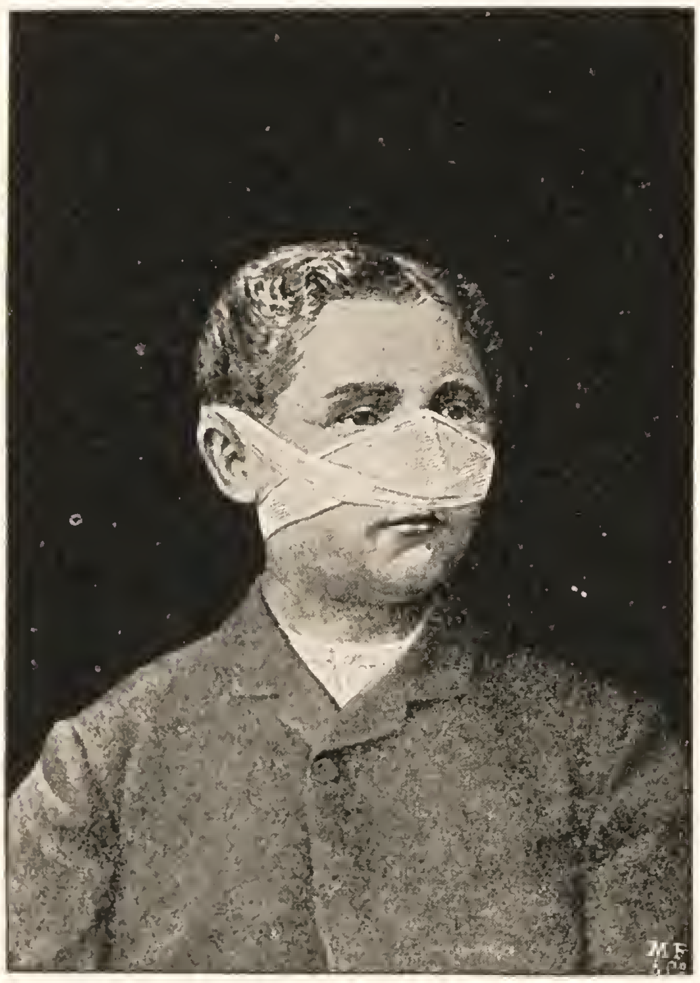


Fig. 83. Bandage for the nose.

Fig. 84. Bandage for the forehead and head.

bring the right-hand corner and the centre of the cloth under the forearm, which is bent at right angles, so that the right corner of the elbow protrudes. Now draw the second corner of the cloth up over the forearm; carry it across the shoulder of the healthy arm, and tie it together with the other corner behind the nape of the neck.

Bandage for the elbow (Fig. 82, *c*). The centre of a folded cloth is placed at the bend of the elbow; one of the ends of the cloth is brought around the forearm, the other backward around the upper arm, and both are then tied together in front.

Bandage for the hand (Fig. 82, *d*). A folded bandage is laid over the palm of the hand, brought around over the back of the hand to the wrist and tied at the wrist.

Bandage for the hand and fingers (Fig. 85). A broad, folded cloth is laid across the fingers, and both ends are drawn over the back of the hand

toward the wrist. The ends are drawn around the wrist and tied. A similar bandage for the foot is shown in Fig. 86.

Bandage for the loins (Fig. 82, *c*). A folded cloth is laid with its centre at the back of the upper part of the thigh; the ends are crossed at the groin, drawn around the loin, and tied.

Bandage for the knee (Fig. 82, *g*). A folded cloth is laid with its centre on the kneepan; one end is drawn over the leg, and the other end over the thigh towards the front, where both ends are tied.

Bandage for the back of the foot (Fig. 82, *f* and *h*). A folded bandage is laid with its centre on the sole of the foot; both ends are crossed at the back of the foot, drawn above the heel and around the leg, and tied in front.

FIG. 85. Loose bandage for hand and fingers.

FIG. 86. Loose bandage for the foot.

Fig. 82 illustrates the proper enveloping of the leg and thigh with a bandage.

BANDY LEGS.—See BOW LEGS.

BARBER'S ITCH (SYCOSIS).—A condition characterised by the appearance of a number of small, red, inflammatory papules and purulent vesicles, each of which is pierced by a hair. If a hair is extracted, the root which follows is elongated, greyish in colour, and shaped like a sausage. When the disease has persisted for some time, a considerable section of the bearded portions of the face may become indurated, as in chronic eczema, or it may be covered with crusts. Scars which are free from hair may also be present. The disease pursues an extraordinarily chronic course, and is probably caused by a microscopic form of fungus (the *Trichophyton*).

The treatment in the early stages is very simple, but should be carried out under the direction of the physician. Thorough washing with soap, the application of soothing solutions and simple ointments, and the extraction of the hair involved, comprise the main features. There are a number of

other skin diseases which in their external characteristics closely resemble sycosis, but which require different modes of treatment. It is important to expose the affected area of skin by shaving off the beard, and this should be repeated for a few years, as the trouble is very likely to recur. There is also a type of non-parasitic barber's itch, which is difficult to distinguish from the parasitic type.

BARTHOLIN GLANDS.—Structures about as large as a pea, and found in the lower portions of the *labia majora*. Their excretory ducts are so small as to be scarcely perceptible, but may be found emptying outside of the hymen. They were described by a Danish physician, Kaspar Bartholin (1585–1629). Inflammations of the genitals may be communicated to these glands through their ducts, and result in the formation of painful swellings about as large as an egg, which sometimes suppurate. The treatment in the latter case consists of a small incision into the superficially situated collection of pus. See illustration under WOMB.

BASEDOW'S DISEASE.—See EXOPHTHALMIC GOITRE.

BATHS AND BATHING.—From the medical point of view baths and bathing may be discussed along a number of lines. Cleanliness, exercise, pleasure, medicinal treatment, each or all may be in the mind of the bather. If the history of primitive peoples is considered, it would appear that they bathed very rarely. "Medicinal sweat baths" were not uncommon, however. Cleanliness seems to have been a more recent object. The early Chinese, Greeks, Romans, and Egyptians often indulged in bathing, and the magnificent ruins of Roman baths testify to the lengths to which the idea of bathing was carried. The history of bathing, and the early opposition of the Christian Church because of the wantonness carried on in the Roman baths, is an extremely interesting phase of history. Cleanliness was far from being associated with godliness at one time.

For exercising and developing the body, bathing in rivers, lakes, and ponds is unquestionably one of the best methods. In suitable climates it may be practised throughout the year, but in the colder climates bathing in fresh water should not be indulged in too late in the season. It is true that many water fanatics bathe in the open also in winter, and for this purpose often cut a hole in frozen streams; but this custom could not be indulged in by everyone. If fanatics choose to bathe in frozen rivers, they are welcome to do so; but if it is maintained by them that this habit is healthy and recommendable for all, such a position is hasty and ill-considered, if not foolish. Cold water baths in the open should be taken only by healthy, strong individuals. Children should also be induced early to bathe and to learn how to swim. Bathing is not advisable for girls and women while menstruating, especially if this function is readily disturbed, or if the water is particularly cold. Bathing should not be indulged in after a full meal; and great caution should be observed that the body does not become chilled,

nor the muscles rigid from over-exertion. A quick, dry rub and brisk exercise are advisable after a bath, particularly if the outside air is below 70° F.

As remedial measures baths of various kinds are very often applied. The vessels for their application are of different sizes and shapes according to the immediate use to which they are put. Tubs for complete body baths are best placed on the floor, in which position assistance by another person may be most readily extended. Bath-tubs sunk below the level of the floor are unpractical. In many establishments pools are provided, which are

FIG. 87. Half bath, with douche.

usually sufficiently large for swimming and meet practically the same indications as are associated with river bathing. One advantage which these indoor pools possess is the possibility of bringing the water up to any desired temperature, so that this form of bathing may be indulged in throughout the year in temperate climates. The one respect in which they fail when compared with the river baths is the fact that the contained water is necessarily not subjected to continuous changes. The amount of water required for an ordinary tub bath is from 40 to 80 gallons. Taken for purposes of cleanliness its temperature should be about 95° F.; immersion should last about ten minutes, and may be followed if desired by a cold douche at 77° F. or less. Massage of the body may also be done in the bath.

The initial temperature of a cool bath should be about 77° F. Cold

water may be slowly added, the outlet being opened sufficiently to keep the water at the same level. The degree to which the temperature is to be lowered had best be prescribed by the physician. Baths of this kind are given in illness to reduce fever, and for this purpose immersion for 5 to 10

FIG. 88. Body bath.

minutes is sufficient. After the bath, the temperature of the patient should be taken per rectum. Whenever it reaches 102.2° F. (39° C.) the bath may be repeated. The patient must be lifted from the bed into the tub and back into the bed again, and then thoroughly dried. These baths were first

FIG. 89. Sitz-bath.

introduced by Dr. Bland in typhoid, but are now used in almost all febrile diseases.

Where there is an accumulation of mucus in the lungs, and also in the convulsions of children, a favourite form of bath consists of immersion in warm water, during which several pails of colder water are poured over

the shoulders and the neck. In another variety of bath the patient is wrapped up in a large bed-sheet, and then lifted into a tub of cold water, the head, however, being kept above water. The patient remains in the bath only a few seconds, whereupon he is lifted out and thoroughly dried. This is a very stimulating procedure, but may be given only to vigorous persons.

In the so-called " half-bath " the bather sits in the tub with his legs outstretched, the water reaching about to his navel (see Fig. 87) ; the temperature should be 50° to 70° F. The individual splashes the water over the chest with his hands, while an attendant pours water from the tub over his shoulders and neck. This should consume about 3 to 5 minutes, at the conclusion of which period another pail of somewhat colder water may be poured over the chest and back. While in the bath, the legs may be rubbed or scrubbed with a brush. It is essential that the body be thoroughly dried after the bath. Where fever is present, the patient should be put back to bed ; in other cases a walk may be indulged in.

FIG. 90. Alternating foot-bath.

In another variety of bath, the patient half reclines, half sits, in a special form of tub (Fig. 88), neither legs nor arms being immersed in the water. This bath is useful for diseases of the abdomen and the chest, and may be taken either hot or cold, as directed by the physician ; cold water can readily be poured over the abdomen. This form of bath is very efficient in certain intestinal diseases, in which case it should be of a temperature of 95° F., the colder water being poured over the abdomen with a sprinkling pot. This bath should consume 3 to 5 minutes.

For the sitz-bath a special form of tub is provided, the front edge of which must be broad, so as not to press on the legs (Fig. 89). The water reaches to about the navel of the bather. When taken warm, it acts as an anodyne, antispasmodic, and sedative. It is indicated in many female complaints, in bladder and sexual diseases in the male, and in the presence of hæmorrhoids. The time required is from 10 to 15 minutes. Cold sitz-baths of short duration (1, 3, or 5 minutes) especially stimulate intestinal

activity, and as they are followed by a congestion in the genital organs they have been employed for impotence in men.

For the foot-bath, a pail or suitable tub is required. It may be taken as a warm bath for cleansing purposes; hot, for the purpose of drawing away the blood from some other part of the body; or cold, followed by rubbing and walking, also for the latter reason. Cold compresses, applied to the head during the bath, have a stimulating effect on menstruation. In another type of foot-bath, the water is allowed to flow over the feet as far as the ankles, as the patient walks about in the tub, for 1 to 3 minutes. This is very effective for relieving the congestion of blood in the head. It may be conveniently taken in any brook. In the alternating foot-bath, the patient immerses his feet in hot water for about five minutes, and then plunges them for 10–30 seconds into a pail of cold water (Fig. 90). After this has been done the feet must be thoroughly dried, whereupon the person should walk about. This serves the same purpose as the last-named form of foot-bath.

FIG. 91. Bath for the hand and the arm.

A bath for the back of the head is very effective in cases of palpitation, dyspnœa, and pollutions. The patient lies on a mattress, beyond the edge of which his head projects, the back of the head being immersed for five minutes or more in a flat basin of cool water.

The "bidet" is a form of bath which renders it easier to cleanse the external genitals, the person using it occupying a straddling position. The water used may be either hot or cold.

The hand and the arm may be plunged into a suitable contrivance (shown in Fig. 91), containing either hot or cold water. This bath is used for the purpose of directing the blood away from the head and breast, and may thus be employed to assist the foot-bath. The elbow-bath is rarely used, as its action is much weaker. An alternating bath for the hands is similar to that described for the feet.

For other varieties of baths, and for medicated baths, see BRAN-BATH; HERB-BATH; HOT-AIR BATH; MUSTARD-BATH; PINE-NEEDLE BATH,

SALT-WATER BATH, ARTIFICIAL; SEA-BATH; SHOWER-BATH; STEAM-BATH; SULPHUR-BATH, ARTIFICIAL.

BEARD.—The hair on the cheeks, chin, and upper lip (moustache). The growth of the beard, as well as that of hair in other parts, depends on the development of these structures from the hair-follicles, which also determine the general character and colour of the hairs. Form, distribution, length, the softness, curliness, and thickness, vary in races or families, just as does the colour. The appearance of the hirsute growth on the chin, lips, and cheeks is an accompaniment of complete sexual development in man. In women this condition must be looked upon as a deviation from the feminine type. Although considered an ornament in men, it is deemed an ugly feature in women. It must be evident that a full beard, unless it is extremely well taken care of, interferes with perfect cleanliness; and a person who insists upon retaining this growth as an adornment ought to realise that it demands his especial care in this respect. The care of the beard includes frequent washing with soap (preferably that known as lanoline soap), thorough drying, and the application of a moderate amount of some simple pomade which does not decompose. The ordinary pomades which have lard or beef-fat as their basis should be avoided, as they readily become rancid and give rise to irritating, fatty acids. Those prepared with a lanoline or vaseline base are preferable.

Excess as well as deficiency of fat interferes with the growth of the hair and beard, and moderation in the application of these toilet accessories should be exercised. Alcoholic hair-lotions, which may be applied about twice a week, serve to remove the fatty materials which have accumulated, and also to cleanse the underlying skin. One of the best preparations for this purpose is the well-known eau-de-Cologne, which is to be applied with a linen rag, the skin afterwards to be rubbed with a dry cloth until evaporation is complete. Frequent combing has a cleansing effect, and, by acting as a massage, it stimulates the growth of the hair. One of the best hair tonics is a very thin alcoholic or fatty solution of wax. The various adhesive preparations which have been recommended are to be zealously avoided, as the rubber which they usually contain readily disintegrates, thus affording a good culture medium for bacteria. Frequent singeing of the hair is harmful unless the hair has first been thoroughly greased. Otherwise it tends to make the hair brittle, dry, and liable to split at the ends. Whenever the latter condition occurs it is safe to say that the hair is too long, and it should be kept cut sufficiently short to prevent this taking place. There is no doubt that frequent cutting or shaving will cause the hair to grow more thickly, but it does not promote a long growth. The beard should be trimmed in such a manner that the lips are left free, and straggling hairs should be brought back into place by the aid of the curling-iron. Disinfecting remedies containing carbolic acid or corrosive sublimate should never be

used, as they cause the hair to break off. Of all the additions to pomades, tannic acid in half per cent. solution is the best.

A perfectly satisfactory remedy for removing a beard from the face of a woman, without producing scars, is not available. It is possible to bring about a falling-out of the hair-shafts by the application of mixtures containing chloride of lime, or sulphide of arsenic, but this does not inhibit future growth from the unaffected follicle. These radical cures must, therefore, be constantly repeated. Moreover, they should be resorted to only under medical supervision; otherwise the cauterising process may extend and form deep ulcers. Regular shaving merely stimulates renewed growth, and does not prevent the discoloration produced by the ends of the hair-shafts remaining in the skin. The systematic extraction of the hair with an epilation-forceps is the only reliable, though somewhat painful, remedy. Certain physicians have recommended destroying each individual hair-follicle by means of a fine platinum wire, which is rendered red-hot by the electric current and then plunged into the follicle. The resulting scars are too small to be very much in evidence. This method must be employed in obstinate cases. Whether the destruction of the hair-follicles by means of the X-rays, as observed under other circumstances, can be made of practical value, has not yet been made the subject of practical tests.

BED.—In order to refresh both body and mind, man spends about one-third of his life in sleeping. In order to fulfil the indications demanded of it, particular attention should be paid to the bed. It must be comfortable in order to furnish complete rest during sleep. The non-activity of the muscles during sleep causes the body to generate less heat than during the waking hours, and the bed-clothes should therefore contribute a greater degree of warmth than the clothing. A bed should not be too soft, as this is conducive to malposition of the body, and a consequent feeling of stiffness on awakening. Nor should it be too warm, as this interferes with evaporation and produces overheating of the body, and perspiration. The resting-place of a healthy individual should consist of a mattress made of horse-hair, or a suitable bag stuffed with clean straw. The head should rest low on a pillow stuffed with horsehair, or with tightly packed feathers. As covering, a single blanket will suffice for the summer; a double blanket of wool, or a quilt, for the winter. Feather-beds are required by a healthy adult only during extremely cold weather in unheated rooms; they may, however, be used for children or old people during other times of the year, but should never be too thick.

On retiring, all clothes worn during the day should be removed, and a suitable night garment put on. The clothes should be hung up, preferably outside of the sleeping-chamber, so that they may be thoroughly aired. The head should remain outside of the covers during sleep, so that the fresh air

of the room and not the emanations from the body are inhaled. Lying on the side while sleeping is preferable to lying on the back. Bed-curtains and draperies should be discarded, as they interfere with the free circulation of air. Iron bedsteads with spiral springs and a divided mattress are to be preferred to a wooden bedstead with its clumsy spring mattress, which is difficult to clean, and which also affords numerous hiding-places for vermin. The bed must rest on legs, so that sufficient space is provided beneath it for the air to reach every part. The bed should be so placed that it is not exposed to draughts, and it should be kept away from windows and stoves. Neither should it be situated next to a damp wall. Every morning the bed-clothes should be thoroughly shaken and aired at an open window, and as often as possible they should be brought into the open air and exposed to the sun. Sheets and other bed-linen should be frequently changed. With regard to suggestions as to choice, ventilation, and heating arrangements for the bed-chamber, see DWELLING-PLACES.

The bed of the sick should stand, if possible, in the middle of the room, accessible from both sides; not too near a heated stove, and guarded against draughts, but without a canopy. The bottom of the bed, usually a spring-mattress, must be even, and uniformly elastic. Castors under the feet of the bed are very useful. The mattress resting upon the springs had best consist of three parts; its most suitable stuffing is horsehair, wool, sea-weed, etc. The middle part, which is most exposed to the pressure of the body, should be thicker than the sides; therefore it should have a slightly convex (curved) surface *without being uneven* (no grooves). For patients who are not cleanly, it is advisable to replace the middle part of the mattress by a sack stuffed with chopped straw. The urine trickles through the latter upon a trough placed under the mattress, and from there into a chamber (see Fig. 92). Special beds with urinals are constructed, and may be used if the expense can be borne.

The mattress should be covered with a linen sheet, which must always be scrupulously clean, free from all deposits such as crumbs of food, and drawn tight and smooth. The latter object is readily accomplished if each side of the sheet is grasped by someone, and drawn tight. If a patient is restless, fasten the sheet to the mattress with safety-pins. Pillows stuffed with feathers must be firmly and well filled, so that the head does not sink in too much. Large bolsters may be used as supports for the head. The coverings of the bed must not hinder

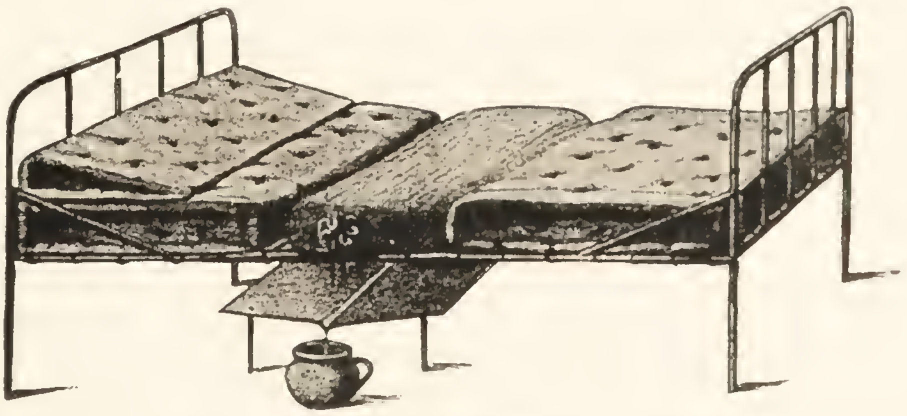


FIG. 92. Bed for patients who soil themselves.

evaporation ; those stuffed with feathers are very unpractical in comparison with woollen or wadded coverlets.

BED-SORES.—Ulcers, generally over the bony prominences of the pelvis in the buttock region, and usually due to long-continued pressure, as from lying on the back for protracted intervals. They may result from disease of the spinal cord ; and they may occur also in the region of the shoulder-blades and the heels. When patients are confined to bed for several weeks as in protracted fevers like typhoid, or in some cases of insanity, these bed-sores are apt to develop unless great cleanliness is insisted upon. To obviate their onset the bed should be carefully prepared, air cushions or water cushions should be provided, the patient frequently turned, and the skin cared for by alcoholic washes and antiseptic powders, formulas for which can be obtained from the physician in attendance.

BEEF-TEA.—See Diet for the Sick ; Sick, Nursing of.

BEER.—A beverage properly prepared by a process of fermentation from water, hops, yeast, and malted barley. In some beers malted wheat is used ; from others, hops are omitted ; and still in others (as in Bohemian beers) a greater proportion of hops than malt is employed. While none of these varieties of beer can be considered really harmful, it is certainly a disadvantage when, instead of hops and malt, the brewer employs tansy, picric acid, glycerine, quassia, sugar, syrup, etc., as substitutes for the essential ingredients. In Germany the superior quality of the Bavarian beers is due to the stringent regulations which have long been in force as to the purity of the ingredients, and for this reason these beers are among the most highly prized in the market. The nutrient value of even these varieties is very slight, however, a quart being scarcely the equivalent in food value of a single slice of bread. It is a great mistake, therefore, to look upon beer as a food ; nor should one delude oneself with the idea that several glasses of beer daily may be taken without detriment.

The ordinary varieties of beer have the following composition :

	Carbonic Acid Gas	Alcohol	Extracts	Sugars	Albumin
Light beers	0·19	3·4	4·59	4·0	0·8
Pilsener	......	3·5	4·97	......	0·37
Münchener	......	3·7	5·8	......	......
Porter	......	5·0	7·6	......	......
Ale	......	5·0	6·0	......	......

The ingestion of a quart of beer, therefore, means the absorption by the system of about 30 grams of absolute alcohol ; the same quantity of whisky would contain approximately about 400 to 500 grams. The difference between a whisky drinker and a habitual beer drinker is not a very great one ; and the liability to injure the health by such habits is a serious one

(see ALCOHOLISM). By the process of Pasteurising, the temperature of the beer is raised to 70° C. (158° F.), which destroys the organisms of fermentation and renders it possible to transport beers a great distance. An increased quantity of alcohol need therefore not be added for this purpose. Beer should be stored for a considerable period and be mature and clear, new beer being more apt to cause intestinal catarrh. Beer which has been allowed to ferment beyond the normal degree, the so-called "weiss bier," contains so much carbonic-acid gas that harmful results from its use may follow; and it should therefore be taken in moderation for a twofold reason.

BELLADONNA-POISONING.—The blackish-red, cherry-like berries of the deadly nightshade (Plate XXIII. Fig. 7) have a sweet taste, but instead of one large seed they have many small seeds. They may be eaten by accident, having been mistaken for huckleberries and mixed with them. Children have been poisoned from eating only three or four berries. Nausea and vomiting generally occur directly after swallowing the berries. This is followed by a burning sensation in the back of the mouth, dryness of the throat, and difficulty in swallowing. The most important symptoms are: dilatation of the pupils, impaired vision bordering on total blindness, scarlet colour of the face and body, and agitation. The patient swings his arms violently, bites, laughs, screams, and whistles. At times there is no agitation, but in its stead profound unconsciousness, resembling a fainting spell. Emetics, ice poultices on the head, and enemas of vinegar may be given until the arrival of the physician.

Occasionally the medicinal preparations of belladonna are taken by accident. The symptoms are as described, and the remedies employed the same. As belladonna causes a loss of sensation in mucous membranes, it is better to wash out the stomach than to wait for an emetic to act. A soft rubber tube is all that is necessary to do this. Tablets containing atropine, the poisonous alkaloid of belladonna, are very widely used for colds in the head; and poisoning from them occurs very frequently. The symptoms and treatment of poisoning by these tablets are as already outlined. Hot coffee is a useful stimulant to be given while waiting for further medical aid.

BENZINE.—A volatile liquid derived from petroleum. It is used to a limited extent in the treatment of parasitic diseases of the skin, and occasionally it has been employed for the purpose of local anæsthesia. It has been swallowed by accident which has resulted in symptoms of poisoning: nausea, vomiting, headache, intense pain, dizziness, increased emotionality, oftentimes accompanied with laughing and crying, rapid heart action, inability to get the breath, and collapse. The only available method of treatment is to evacuate the contents of the stomach.

BENZOIN.—A balsam obtained from *Styrax benzoin* and other unknown species of *Styrax*, natives of the East Indian Islands. The active principles are benzoic and cinnamic acids and various ethers and alcohols. Besides

being extensively used in perfumery, benzoin is employed in medicine as a stimulating expectorant, being of service in the earlier stages of cold in the head, loss of voice, and mild bronchitis. When combined in the proportion of one part to ten of water, or an appropriate salve, it is useful in the treatment of cracked lip, cracked nipple, a rough complexion, etc.

BERIBERI.—A form of neuritis, possibly infectious in nature. See NEURITIS.

BEVERAGES.—Water forms approximately 60 per cent. of the weight of the animal body. The different structures of the body vary somewhat in their water contents, as follows: Bones, 22 per cent.; liver, 69 per cent.; muscles (flesh), 75 per cent.; and kidneys, 82 per cent. These figures clearly demonstrate the great importance of water to health. Man is much less able to do without drinking than without eating. He can live only a few minutes without air, a few days without water, but several weeks without solid food.

The list of beverages is headed by water, which is best when it remains uniformly clear and colourless, even upon standing for some length of time; when it is without odour and without taste, and uncontaminated with animal refuse. It may without detriment contain moderate amounts of carbonated lime-salts. Water taken between meals promotes the appetite, and favours digestion, whereas the latter is retarded by alcoholic drinks. Care should be taken not to swallow large quantities of water. Excessive heat and great cold should also be avoided. The ideal temperature for beverages is between 50° and 66° F. German medical authors for the most part insist that these limits be not exceeded; but it is highly improbable that a moderate indulgence in drinks of either higher or lower grades of temperature is particularly harmful.

Water taken in combination with the juices of fruits, in the form of lemonade, orangeade, etc., is a very refreshing and agreeable beverage, which neither the wanderer when walking, nor the farmer during his work, nor the soldier when marching, need deny himself, even if the drink is cooled to a low temperature. Neither does it harm a heated person when resting, provided he is careful to drink slowly and in small draughts. Similarly, water in the form of hot soup or hot tea will on cold days warm the chilled body more rapidly and more lastingly than if alcohol is added. When alcohol is taken, the warming is merely an apparent one, and a depression of temperature will follow its use. See WATER AND DRINKING OF WATER.

BICYCLING.—A useful form of exercise which, however, is very apt to be carried to excess. For medical reasons, bicycle racing should be discouraged, while ordinary riding and fancy riding may be recommended. Bicycling may be practised to a moderate degree up to an advanced age (60 years and over) if the person doing so is used to it for many years. But individuals of more than 50 years of age should generally be dissuaded from

taking up this form of exercise, and those over 40 years of age should begin it only in case they have been previously accustomed to other regular, bodily exercises. Since children up to the fourteenth year of life have a great tendency to enlargement of the heart, and since bicycling more than many other exercises of the body makes special demands upon this organ, the practice of the same should generally not be begun until after this period. The question whether girls and women may ride the bicycle has long since been decided in the affirmative. Patients suffering from mild degrees of affections of the heart and lungs may also, after previous consultation with their physician, practise bicycling. If practised rationally, it often exerts a favourable influence upon the organs of the abdomen. This is frequently experienced by women suffering from abdominal affections. It is obvious that here, too, a previous consultation with the family physician is necessary. Fancy bicycling is practised very little. This is the more to be regretted as it is a very suitable exercise for the body, owing to its many-sidedness. Since bicycling generally causes profuse perspiration, it is necessary to wear good woollen or cotton undergarments, and to protect the body from catching cold by completely closing the outer clothes when resting. Alcoholic drinks should not be used before or during bicycling.

If bicycling gives rise to morbid disturbances, such as palpitation of the heart, vertigo, peculiar pressure sensations in the head, or even loss of appetite, it must be given up entirely. In recent years a peculiar form of nervous disturbances in cyclists has been observed. This must be ascribed not only to an excess of cycling, but also to the fact that not everyone is fit for this one-sided exercise of the body. If a cyclist observes difficulties in voiding the urine, a frequent occurrence in more advanced years, he should consult a physician. This affection is often associated with an enlargement of the prostate gland, and demands suspension of bicycling. It appears that the pressure of an unsuitable saddle upon the perinæum favours the development of this affection. It is important, therefore, to pay attention to the character of the bicycle saddle.

BILE.—The most characteristic secretion of the liver. It is elaborated mostly from the blood through the agency of the liver-cells, is collected into the hepatic duct from the biliary ducts, and is ultimately discharged into the upper end of the small intestine just below the opening of the stomach into the duodenum. The gall-bladder serves as a storage reservoir of bile, the secretions being conveyed from that gland to the common duct by means of a special channel, the cystic duct. See Liver in Introductory Chapters. The bile is at first a light-coloured, thin liquid, but in the gall-bladder it becomes darker and heavier from admixture of mucus, and from oxidation ; and as ordinarily discharged into the intestines it is greenish to yellowish, becoming darker as oxidation progresses. Thus diarrhœal stools may be greenish or light yellow because of the presence of partly oxidised

bile. Chemically, bile is an alkaline fluid with a bitter taste, containing much water, alkaline salts, colouring-matters (bilirubin ; biliverdin), fat, cholesterin, bile acids (glycocholic and taurocholic), lecithin, and soaps.

The uses of the bile are various. It aids in elimination, many poisonous, broken-down products being thrown off from the body through the bile ; it aids in the digestion of fats by assisting in their saponification ; it probably plays an antiseptic rôle, thus keeping down the number of intestinal bacteria ; and it is an important factor in regulating the normal movements of the fæcal contents of the intestines, constipation being almost invariably a concomitant of diminished bile production or elimination. The bile has undoubtedly other functions, but they are but little understood. Under certain circumstances, as yet not fully determined, the salts of the bile, or the cholesterin, precipitate and gall-stones are formed. These often give rise to serious attacks of pain, and often their presence jeopardises the life of the patient. See GALL-STONES.

BILIOUSNESS.—A form of self-poisoning or auto-intoxication usually due to defective intestinal functions rather than to any affection of the liver itself. The usual onset of an attack is preceded by an uncertain amount of indigestion due to a mild catarrhal inflammation of the stomach and duodenum. This mild grade of inflammation causes the mucous membranes to become somewhat thickened, thus narrowing the common duct, and diminishing the amount of bile that may pass into the intestines. The inflammation, together with the absence of the bile, permits of an excessive amount of intestinal putrefaction and fermentation, and, as a result, headache, perhaps nausea and vomiting, constipation, general misery, clayey stools, dark urine, and slight jaundice develop in milder or severer forms. Alcoholic drinks, excessive eating, particularly of foods rich in fat, lack of exercise, etc., are often the causes of the initial intestinal disturbances. The treatment should consist in large part of restriction in diet (sometimes an absolute water diet is necessary), mild catharsis by a non-irritating cathartic, and hot-water enemas. See BILE ; CONSTIPATION ; LIVER, DISEASES OF.

BIRCH.—The bark and leaves of *Betula lenta*. Birch bark and leaves contain an active volatile oil very closely resembing oil of wintergreen, and consisting largely of pure methyl salicylate. This substance has the action of the salicylates in general, being particularly useful in acute articular rheumatism, either applied locally or taken internally. See SALICYLIC ACID.

BIRTH.—See PARTURITION.

BIRTHMARKS.—Yellow or brownish black, round or oval, raised, sometimes hairy or warty marks on the skin ; and sometimes supplied with a stalk. Generally they consist of congenital deposits of pigment in a morbidly changed portion of the skin, or of collections of densely interwoven blood-vessels (nævi). They are not due, as is so frequently held, to " taking fright during pregnancy," nor to the "sins of one's ancestors," etc. They

are related either to warts or to strawberry-marks (port-wine stains); and they can be removed only by operation.

BIRTH, PREMATURE.—See ABORTION.

BISMUTH SALTS.—The soluble salts of bismuth are all too poisonous to be utilised in practical medicine. The insoluble salts, however, are widely employed as intestinal antiseptics and as anti-fermentatives in affections of the stomach and intestines. The salts of bismuth most in use for this purpose are bismuth salicylate, bismuth subcarbonate, bismuth subgallate, and bismuth subnitrate. These are used in comparatively large doses (15 grains up), especially the more insoluble ones, such as the subcarbonate and subnitrate. There are a large number of other bismuth compounds known, but those mentioned are the only ones in extensive use.

BITTERS.—Substances which by their action on the nerves of taste increase the sense of appetite and also stimulate the muscular mechanism of the stomach. Most of the bitters of the market are alcoholic drinks, thinly disguised by the addition of some plant bitter. Some of them are as strong as whisky; most of them are stronger than strong wines. Aromatic and simple bitters are recognised in medicine, the former containing, in addition to the bitter principle, an aromatic volatile oil. Simple bitters are quassia, gentian, chiretta, calumba, and nux vomica. Aromatic bitters are wild cherry, horehound, cascarilla, angostura, serpentaria, chamomile, etc.

BLACK DEATH.—See PLAGUE.

BLACKHEADS.—Small swellings in the skin, due to obstruction of the openings of the sebaceous glands. The most superficial part of the extruding fatty matter dries and turns black (hence blackhead). Actual exudations of sebaceous masses of the glands of the skin take place, and can be brought out by pressure between two finger-nails or a watch-key, the exuding matter creating the impression of a whitish worm. The sebaceous plugs, which greatly disfigure the skin, often develop simultaneously with an over-production of a glistening tallow of the skin (*stearrhea*) about the nose, lips, and forehead. By destruction of entire sebaceous glands, they lead to blotches, to the formation of furuncles, and to various eminences of the skin.

The principal preventive is scrupulous cleanliness, frequent bathing, massage, the use of sulphur soaps, and the addition of tar and wax-paste to the soap. Benzine is an excellent and harmless remedy to dissolve the plugs, and serves to facilitate the squeezing (also with a watch-key), and also as a means for the removal of the outflowing skin-fats. Constipated habits should be overcome.

BLACK-WATER FEVER.—A disease thought to be a severe type of malaria. It is observed in various bad malarial regions, but chiefly on the coast of tropical Africa; and it is characterised by fever, generally ushered in by a severe chill, serious constitutional symptoms, vomiting, jaundice,

and a peculiar discoloration of the urine, due to the sudden destruction of a large number of red blood-cells. This last characteristic, being the most striking to the lay mind, has given the name to the disease. The urine may have a Bordeaux-red colour, or resemble coffee, porter, or Malaga wine, or may even become blackish-brown, owing to the copious admixture of the colouring-matter of the blood. The disease lasts from a few days to a number of weeks. It rapidly produces severe anæmia and loss of strength, and often has a fatal outcome.

Black-water fever occurs as a rule in persons who have spent a considerable period of time in a malarial region, and who have perhaps already passed through several attacks of malaria. It is rarely observed within the first six months of a sojourn. Among the incidental causes, quinine seems to play an important rôle. The attack often follows immediately upon the use of the drug, at times even upon the taking of a very small dose. The quinoline derivatives, of which quinine is one, have the power of causing blood changes ; and it may be that the extra stress put on the blood by even small doses of quinine aids in the hæmolysis. It is essential to summon a physician as soon as possible, a desideratum often difficult to fulfil in the tropical regions in which the fever is endemic. The patient must forego the use of quinine ; and the suppression of urine, which ordinarily occurs in the disease, must be combated by the absorption of large amounts of fluids, especially mineral waters and milk. The prophylactic measures are identical with those for malaria. It may be that this disease is due to a micro-organism allied to, yet distinct from, that of true malaria.

BLADDER.—For structure and functions, see Urinary Organs in Introductory Chapters (pp. 150–151).

BLADDER, DISEASES OF.—Under this general heading will be described some of the more common affections of the bladder.

Cystitis.—Inflammation of the bladder, or vesical catarrh, may vary greatly in its manifestations, and may be due to any one of many causes. Retention of urine and injuries, however slight, to the mucous membrane lining the bladder seem to be important factors. Mechanical, infectious, or chemical influences also play a part in the production of the further development of the disease. The most important causes may be summarised as follows : abrasion of the mucous membrane and infection of the interior of the bladder by instruments introduced for various purposes ; bacteria, which find their way from without on instruments, from within by transmission from the ureters, the pelvis of the kidney, and the large intestine ; foreign bodies, gravel and stones, which have been formed in the bladder or in some portion of the urinary tract higher up ; narrowing of the calibre of the urethra ; obstruction to the regular passage of the urine by enlargement of the prostate, due to advanced years ; acute and chronic gonorrhœas, tuberculosis of the bladder ; chemical irritants, such as acrid

remedies used for washing the bladder, and the administration of drugs like cantharides (Spanish fly); and, finally, the not generally acknowledged influence of exposure. As regards the last-named, there is no doubt that a cold aggravates an already existing catarrh of the bladder.

In an acute attack of vesical catarrh the symptoms consist in a frequent desire to urinate, and the passing of urine rendered cloudy by the admixture of pus and mucus, and occasionally bloody. The blood is usually noticed with the last drops of the urine, which is scanty in amount but frequently voided. Fever and a moderate degree of constitutional disturbance are often present. The greatest annoyance, however, is caused by the constant desire to urinate, which also interferes with proper sleep. The chronic catarrhs are accompanied by fewer general disturbances; but the local symptoms, the urinary changes, are more marked, and the disagreeable odour due to the decomposition of the urine is a source of continual annoyance.

The main indications for treatment must be prescribed by the physician after the exciting causes have been determined. It should be borne in mind, however, that in addition to the necessary medical and instrumental treatment, every case of vesical catarrh demands proper attention on the part of the patient. Rest in bed is to be recommended as a safe way of avoiding cold, and also for the maintenance of uniform bodily warmth. Warm sitz-baths and full baths are useful, especially where there is difficulty in passing urine. Alcoholic drinks and richly seasoned dishes had best be entirely avoided; and attention should be given to the daily emptying of the bowels. It is well to abstain from taking natural or artificial mineral waters which contain much carbonic-acid gas. In the presence of chronic catarrhs it is important to avoid the dangers attendant upon self-catheterisation by following closely the directions for the cleansing of instruments employed for this purpose. See CATHETERISM.

Hæmorrhage from the Bladder.—A condition which may appear as one of the symptoms of catarrh, of stones (especially after violent exertions), or of tumours or injuries of the bladder, the latter particularly if the hip be fractured. Before any final decision can be reached in regard to the cause of the bleeding, whether it is derived from the bladder itself or from the upper portion of the urethra, a careful chemical and microscopical examination of the urine is necessary, supplemented, in certain cases, by an examination of the interior of the bladder by the aid of artificial light. Where severe spasmodic cramp in the bladder is present, there is, in all probability, a catarrh; when there is marked pain after urinating, a stone is very likely present; and when hæmorrhage appears without other known cause, a tumour of the bladder probably exists. In every case of hæmorrhage from the bladder, even in that following injury, complete rest must be enjoined until the arrival of the physician; and where injury has taken place, an ice-bag is

to be recommended. Hot-water bags are useful in reducing the pain ; or cloths wrung out of hot water, and on which a drop of turpentine has been placed, may be used.

Paralysis of the Bladder.—A condition usually accompanying diseases of the spinal cord. It may occur also during unconsciousness, or as a result of gradual degeneration of the muscles of the bladder from chronic inflammatory processes : catarrh, urethral stricture, and enlargement of the prostate gland. The paralysis involves partly the sphincter and partly the expulsive muscles, so that the urine either cannot be retained in the bladder, and is constantly dribbling, or cannot be properly voided, because the expulsive power is lost and retention results. The prognosis and the treatment whether palliative, radical, or otherwise, must be left entirely to the discretion of the surgeon. Where there is retention of urine, catheterisation will probably be found necessary.

Spasm of the Bladder.—A peculiar disturbance of urination, due to some irritation of the neck of the bladder, all the causes of which are not as yet fully understood. It sometimes follows the use of alcoholic drinks which have not been completely fermented ; and it is often present in cystitis or inflammation of the bladder. The condition is characterised by an intense desire to urinate, which persists for some time after the bladder has already been emptied. Attempts to pass the urine result in the expulsion of only a few drops, and call forth a severe burning pain. The desire soon returns, however, and continues for some time until the normal condition is again restored. In rare cases, the vesical spasm, which may vary from a dribbling of the urine to complete retention, is the result of nervous disturbances, and this form naturally demands medical attention. The other type is usually transitory, and may be satisfactorily combated by the plentiful administration of warm drinks or alkaline waters, the use of bicarbonate of soda, and a hot sitz or a warm body bath. Persons who are liable to this otherwise harmless form of vesical spasms, should avoid the use of incompletely fermented beverages. A similar train of symptoms may also be present at the onset or during the course of an acute catarrh of the bladder, or when there are stones or foreign bodies in the bladder. The immediate cause in any given case must be carefully determined by the physician in attendance.

Stones in the Bladder.—Bladder-stones, or calculi, are found in adults and children, but are more often observed in men than in women. The chemical composition varies widely, and a number of substances may be present. The colour, size, form, and hardness are also subject to wide variation. Urates, phosphates, and oxalates of the alkalies, sodium, and potassium, are the most frequent components (see Plate XIII., Fig. 1, *a*, *b*, *c*). Calculi are commonly formed about some particle of gravelly material, which finds its way from the pelvis of the kidney and becomes enlarged

in the bladder by the deposit of the substances enumerated. Foreign bodies which have entered the bladder may also serve as a focus of accretion. The chemical composition of these stones has little to do with the symptoms which they produce. A calculus may remain in the bladder for a considerable period of time before the patient becomes aware of its presence. In fact, many patients may never know they have a stone in the bladder. As a rule no pain is felt until the stone, by constant rubbing, has produced an injury to the lining mucous membrane of the bladder, usually near the neck. The pain is ordinarily felt radiating out toward the glans penis at the completion of urination. Violent movements, such as riding, jumping, dancing, fighting, etc., may bring about a hæmorrhage from the bladder. Sometimes there is sudden stoppage of the urinary stream, the normal course of which is resumed after the patient makes some characteristic movements. The patient at this time may experience a feeling of some sudden mechanical obstruction. When a stone has been in the bladder for a considerable period of time, a chronic catarrh usually develops. An important point in the diagnosis of many cases is a history of previous attacks of renal colic, but in most instances judgment can be passed only after a thorough medica examination, including abdominal and rectal palpation, introduction of a stone searcher, and perhaps the illumination of the interior of the bladder by artificial light. X-ray examinations are also useful in detecting the presence of vesical calculi (see Plate XV.).

Operative interference is ordinarily indicated, for there is no internal method of treatment as yet known by means of which a stone may be dissolved in the bladder. All that medication may accomplish is the prevention of gravel formation in the kidney, thus doing away with the production of one form of focus around which calculi can be deposited when this material finds its way into the bladder. On the other hand, internal treatment or a course of waters at some mineral spring may seem to produce a beneficial result, because of its good effects on the accompanying vesical catarrh. In most cases, a combination of medical and surgical treatment, together with a suitable diet, is indicated. The diet depends somewhat on the composition of the calculi previously obtained, and this knowledge should also influence the selection of an appropriate mineral water. Where there is present an increase of uric acid, the patient must avoid eating large quantities of meats, sour foods, strong and acid wines and beers, and adhere mainly to a diet composed of milk and vegetables. The fancied difference between red and white meats is not based on correct chemical analysis.

Among the mineral waters, those from the following springs have been recommended: *European*: Fachingen, Wildungen, Vichy, Carlsbad, and Marienbad; *American*: Saratoga, Alma, Blue Lick Springs, and Mt. Clemens. If the calculi are made up of oxalates, the same waters may be

taken, and all vegetables containing much calcium oxalate (rhubarb, spinach, etc.) must be avoided. In the presence of phosphatic calculi, acids (especially those derived from plant sources) and carbonated waters may be recommended.

Tumours of the Bladder.—New growths in the bladder may be either benign or malignant in character. An accurate diagnosis cannot as a rule be made from the examination of bits of extruded tissue that may be found in the urine. It is usually found necessary to illuminate the interior of the bladder (cystoscopy), or to expose its cavity by an incision (cystotomy). When a hæmorrhage takes place from the urethra without any known exciting cause (such as gonorrhœa), suspicion should always be directed to the presence of a growth in the bladder. During the early stages of their formation, these tumours are not distinguished by any clearly defined symptoms. There is present a more or less chronic process, to which urinary difficulties and evidences of catarrh are later added. After the diagnosis has been confirmed, surgical interference is necessary; and the prognosis, based on the advances in modern technique, is usually very favourable, except in those instances where a malignant growth, such as cancer, is found. This fact should be constantly borne in mind, as it illustrates the great importance of early operation for these malignant cases. Delay is usually fatal.

BLEEDING.—See Hæmophilia; Hæmorrhage.

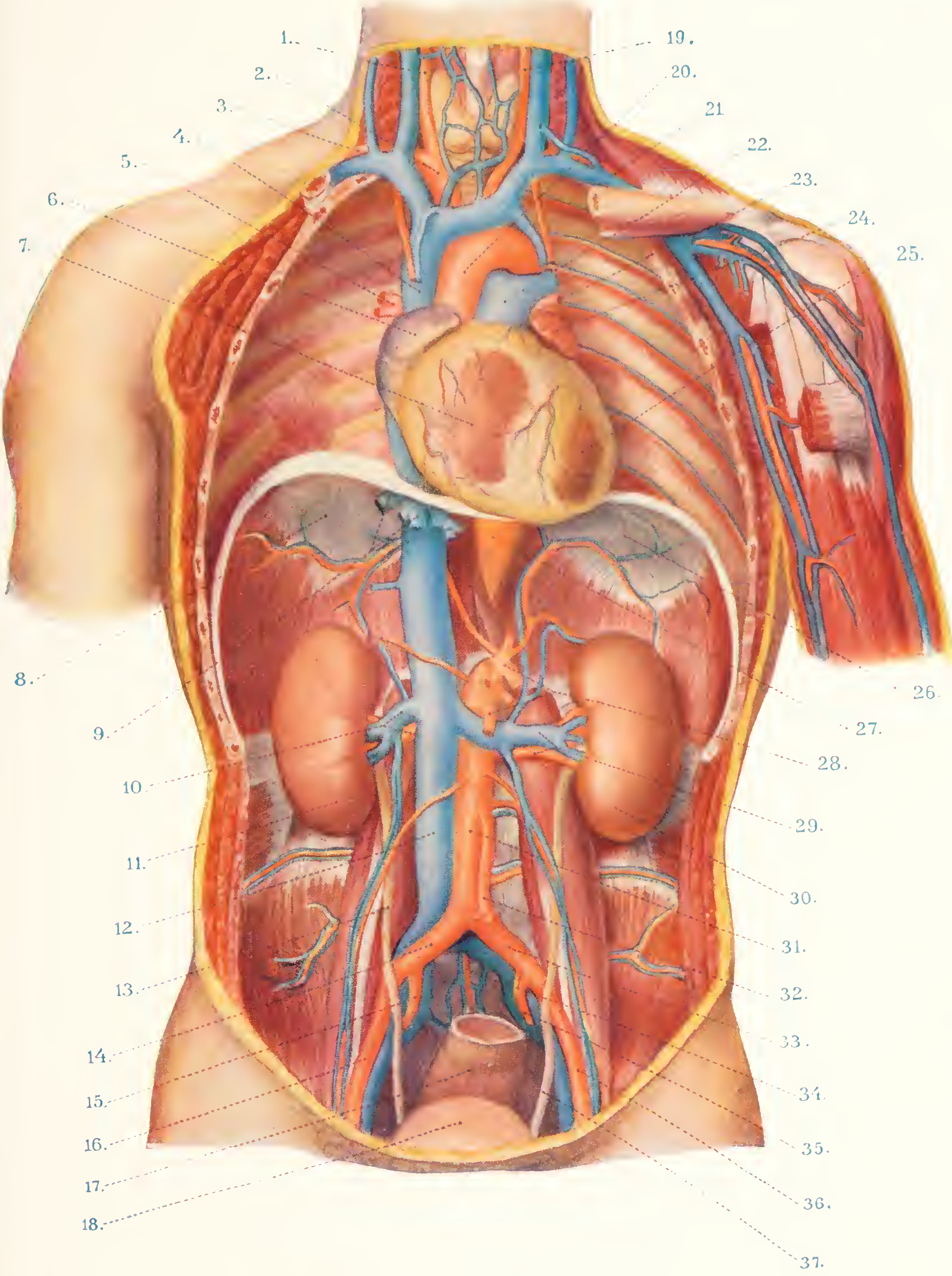
BLEPHARITIS.—See Eyelids, Diseases of.

BLIND, ASYLUMS FOR THE.—Aside from the institutions for the care of the blind which are known to have existed in China thousands of years ago, the first asylum of this kind was founded in Paris, in the year 1784. Shortly afterward, similar institutions were started in Liverpool, Edinburgh, Bristol, and London. Asylums were founded in Berlin and in St. Petersburg in 1806; in Vienna, 1808; and in Dresden in 1809. At the present time almost every civilised country is amply supplied with asylums of this character. As a rule they have been founded by private individuals, the state having lent its assistance at a later date. In some countries attendance is obligatory; the children are entered at the age of six, and remain under instruction until the eighteenth or twentieth year. After that they either follow their own inclinations, or are provided for in special avenues of employment connected with the institution.

In the United States the earliest institution of this kind, the New England Asylum for the Blind, was founded in 1829, in Boston. It was opened in 1832, a few months after the opening of the New York Institution for the Blind. In the following year (1833) a school for the blind was opened in Philadelphia; and in 1899 there was 40 such schools in the United States, a special school for the coloured blind having been opened in 1869. All the States of the Union now make provision for the blind.

PLATE V.—BLOOD-VESSELS OF THE CHEST AND ABDOMINAL CAVITY

1. Right common carotid artery
2. Right innominate artery
3. Right subclavian artery
4. Superior vena cava
5. Right pulmonary veins
6. Right auricle
7. Right ventricle
8. Diaphragm
9. Hepatic veins
10. Right renal artery and vein
11. Right kidney
12. Inferior vena cava
13. Right ureter
14. Right common iliac artery
15. Right internal iliac artery
16. Right external iliac artery
17. Rectum
18. Bladder
19. Left common carotid artery
20. Aorta
21. Left subclavian artery
22. Pulmonary artery
23. Left pulmonary veins
24. Left auricle
25. Left ventricle
26. Diaphragm
27. Aorta
28. Celiac axis. Superior mesenteric artery
29. Left renal artery and vein
30. Left kidney
31. Aorta
32. Inferior mesenteric artery
33. Left common iliac artery
34. Sacral artery
35. Left internal iliac artery
36. Left external iliac artery
37. Left ureter


1.
2.
3.
4.
5.
6.
7.
8.
9.
10
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.

BLINDNESS.—Term referring to the inability of an eye to perceive light; practically, however, the designation of "blind" is applied to individuals whose sight is impaired to such an extent that they cannot find their way about. In most countries where vaccination is universally employed, the number of the blind has markedly decreased. Where this operation is not compulsory or is not used to any great extent, smallpox is the most frequent cause of blindness. At the present time the most common cause of blindness among civilised peoples is the purulent, or gonorrhœal, conjunctivitis of the new-born.

Blindness may come on at any time of life, when the transparent parts of the eye become impervious to light as the result of extensive corneal cloudiness, closure of the pupil from inflammation of the iris, cataract, diseases of the retina and choroid, affections of the optic nerve, or severe injuries to the eye. Diseases of the brain and spinal cord may also bring on blindness. As a general rule, cases of blindness which are congenital, or which are due to disease of the retina, the optic nerve, or the brain, must be looked upon as hopeless. Partial blindness is a term applied to that condition in which a portion, even one-half, of the visual field of one or both eyes is affected, so that the patient is blind in spots (*amblyopia*) or sees only those objects which happen to come on either the right or the left side of the median line (*hemianopsia*). Such forms of blindness usually result from injury to the nervous elements of the eye.

The term "psychic blindness" or "mind blindness" is applied to a condition in which, as the result of destruction of certain portions of the brain, the patient can still see, but is unable to interpret what he sees.

BLISTER.—An effusion of serum underneath the superficial skin. It may be brought about by an irritating agent, extreme heat (as in a burn), extreme cold (as in freezing), or by a variety of other physical and chemical agents. Thus X-rays, the electric spark, radium, etc., can cause blisters on the skin; or they may be produced by such substances as mustard, cantharides, and similar pharmaceutical agents. In medicine, blisters are most frequently produced by mustard, cantharides, turpentine, or by the actual cautery. The chief action of a blister is as a counter-irritant. Whereas it is frequently believed by the laity that such blisters draw the morbid matter to the surface, and that thus the cause of an illness is removed, the true action is far different. It consists really in setting up a nervous reflex action in the sympathetic nervous system. It has been established that practically every internal organ of the body has a representation in the superficial layer of the skin, and that influences acting on the organs may show themselves by changes of greater or less degree of definiteness in these superficial, related areas. Conversely, irritations of these areas in their turn can bring about modifications in the activity of the organs themselves, particularly in the matter of their blood supply.

In the endeavour thus to modify the internal organs, or parts lying in close proximity to the organs, this counter-irritation may be used. Thus, in the treatment of pleurisy and pneumonia, counter-irritation is helpful to give muscle-tone to the blood-vessels of the lungs and pleura, and it may assist in preventing over-distention, with resulting paralysis, in these blood-vessels. Counter-irritation is also widely employed to overcome neuralgia. Here the counter-irritation is thought to bring about a similar modification in the condition of the blood-vessels of the nerve-trunks; and the good effects that follow application of the actual cautery, or of fly-blister, along the course of the sciatic nerve in sciatica are to be interpreted in some such manner.

Blisters are very frequently used in other regions of the body. Thus, used on the knee-joint they are helpful in diminishing suffusion or the collection of water on the knee; at the back of the neck they are often useful in relieving chronic headaches; and in chronic joint-diseases in general they are often very helpful. In the use of blisters, care should be taken that the serum does not become infected.

The use of blistering agents has diminished considerably within recent years, as newer and more effective modes of treatment have come into service for such affections in which blisters were formerly used. The argument is not that blisters are no longer effective—they are as useful as ever—but that other methods of treatment are even more serviceable.

BLOOD.—See INTRODUCTORY CHAPTERS (pp. 107–109).

BLOOD-DISEASES.—See ANÆMIA; BLOOD-POISONING; HÆMOPHILIA; VENEREAL DISEASE.

BLOOD-LETTING (VENESECTION).—A very old remedial and therapeutic measure. Certain observers have claimed that animals at times deliberately bite into their blood-vessels in order to abstract blood. This observation is supposed to have prompted similar experiments in man. The old Greek physician Hippocrates, who flourished about 400 B.C., recommended the procedure for various ills. Alternately combated, praised, used to excess, or almost entirely forgotten, it was gradually abandoned during the latter half of the nineteenth century. More recently, however, it has again attracted attention. At present venesection is resorted to in certain diseases for the purpose of removing the blood from an overfilled and exhausted heart in order to lighten its work and increase its strength. It is employed also to relieve congestion of various organs which temporarily contain an excessive amount of blood, and for the purposes of removing poisonous materials and stimulating the production of new blood. The principal conditions in which blood-letting may be of service are pneumonia, pleurisy, heart disease, cerebral hæmorrhage (apoplexy), epilepsy, and a number of intoxications due to endogenous poisons.

Venesection is usually done from one of the large veins of the arm, sometimes from vessels of the foot. The vein is opened with an ordinary

scapel, or with a special instrument in which the knife-blade is suddenly pushed into the vein by the aid of a spring. The instruments used must be aseptic. Before opening the vessel, the limb is constricted with a circular bandage above the site selected, in order to fill up the veins and make them more readily accessible. The resulting small wound heals within a few days, during which time the limb must be kept quiet. The patient should remain in bed after the operation, in order that the ensuing perspiration may be utilised to its fullest extent. Fainting-spells or attacks of weakness rarely occur during blood-letting; but in order to avoid them the procedure had best be conducted in bed. It is not advisable that venesection be undertaken by laymen.

BLOOD-POISONING (SEPTÆMIA).—A general systemic poisoning, caused by the absorption into the circulation of the poisonous products of certain bacteria. It may be complicated by the presence in the blood of the micro-organisms themselves. The symptoms comprise a high temperature, a feeling of weakness and fatigue, a pyæmic coma or delirium, and repeated chills. Some of these cases are rapidly fatal. There is a popular conception that many diseases are connected with a previous attack of blood-poisoning; and simple inflammation, with redness of the surrounding skin and swelling of the affected limb is often regarded as a like condition. This conception is fallacious, for it is essential that the bacteria or their poisonous products gain entrance into the bloodstream before one can properly speak of blood-poisoning, or septæmia. The first intimation of this is usually a severe chill. The only way in which this dangerous condition may be avoided is by early and appropriate treatment of every septic inflammation; where pus is present it should be removed as soon as possible by proper incisions, in order to prevent the absorption by the blood of the toxic substances.

Some of the worst cases of septæmia follow childbirth. In these instances lack of cleanliness results in the infection of the wounded surfaces of the uterus; and absorption of toxins or bacteria, or of both, bring about puerperal fever. The most important septæmia-causing micro-organisms are the *Staphylococcus* and *Streptococcus pyogenes aureus*. Septæmia is a factor also in many cases of typhoid fever, pneumonia, and syphilis. An entirely different type of blood-poisoning is found following the use of certain drugs. These remedies are for the most part examples of modern synthetics, in which the carbolic-acid nucleus forms an integral part. When taken in large doses they cause certain changes in the blood whereby its oxidative functions are interfered with, either by a fixation of the hæmoglobin action or by a destruction of the blood-corpuscles themselves. Such drugs as acetanilid (an important ingredient in many headache-cures), antipyrin, sulphonal, etc., may cause poisoning of the blood by rendering its oxidation impossible or difficult. As a result of the action of certain blood-poisons,

such as rattlesnake venom, the blood-cells are destroyed. See POISONING. It is of interest to note that Oliver Wendell Holmes was the first to teach the infectious nature of puerperal septæmia.

BLOOD-VESSELS.—See INTRODUCTORY CHAPTERS (pp. 154–157).

BLUES.—See INSANITY; OBSESSIONS.

BODY-LOUSE.—See LICE.

BOIL.—Term applied to a collection of pus under the skin, which may occur during the course of an acute or chronic inflammation of the skin or

FIG. 93. X-ray picture showing fractures of both bones of the forearm (radius and ulna).

FIG. 94. X-ray picture showing fracture of ulna (side view).

other organs. According to whether the pus is the result of an acute or a chronic process, so-called hot and cold abscesses are distinguished. The former are accompanied by redness of the skin, a feeling of heat in the affected part, a severe, pulsating pain, and, usually, fever. A cold abscess is free from these symptoms, or they are present only in small degree. The superficial forms in the skin are termed boils; the deeper-seated ones, carbuncles.

An abscess results from the effort of the body to combat a bacterial foe. If this does not succeed, either because the overlying skin is too thick or because some improper mode of treatment, such as massage, has been applied, particles of pus are absorbed by the body and distributed to various parts, resulting in a general blood-poisoning or pyæmia. It is therefore very

important to assist in the formation of the abscess by putting the part at rest and improving its circulation; and as soon as the pus has gathered, to give it free exit by means of an incision into the skin. Rest may be secured by putting the limb on a splint. It should then be kept elevated and furnished with a warm, moist dressing. As soon as the abscess is fully developed ("ripe") it should be freely lanced. The most frequent bacterium found in boils is the *Staphylococcus pyogenes aureus*. The *Bacillus tuberculosis* is primarily responsible for many cold abscesses.

Fig. 95. X-ray picture showing fracture of the thigh-bone, or femur.

BONE.—For structure, shape, number in body, composition, and functions, see INTRODUCTORY CHAPTERS (pp. 120–130).

BONE, FRACTURES OF.—Complete breaking of a bone is designated as *fracture*. If the break affects only a part of a bone section, it is called an *infraction*; if only cracks and clefts are caused, it is called a *bone fissure*, or at times a *green stick fracture*; if only a small part of the bone is detached, it is a *splinter*. In case the skin over the point of the fracture is also torn, the fracture is designated as *open*, *complicated*, or *compound* (see Plate XVI. and Figs. 93, 94, 95).

The surest sign of a fracture is the displacement of the separated parts of the bone, which sometimes can be recognised even externally in that one or both fragments project distinctly under the skin. Greater certainty is afforded by palpation of the skin over the fracture by the physician, so long as no material swelling has occurred. Every touch and movement which may cause a displacement of the fragments of the bone will give rise to great pain. Regularly, owing to simultaneous contusion of the soft parts, there is a more or less profuse loss of blood which, with the direct injury, causes great swelling. The fractured limb should not be used. Healing takes place by the formation of new bone at the fractured ends. This bone-mass (*callus*) is at first soft, but later it becomes very hard and firmly unites the fragments of the bone (see Fig. 68). If the fragments remain in the correct position during the time required for the healing, the fracture heals straight; otherwise, more or less crooked, as a rule causing a shortening of the limb (see Fig. 69).

If it is not possible in cases of fracture to obtain the aid of a physician immediately, emergency splints should be applied; the helper must, however, make it his *only* object to allay the pains of the injured, and must make *no attempt* to adjust the displacement of the bones. The bones most

exposed to fracture are the long, tubular ones (upper arm, forearm, thigh, and lower leg). After having removed the clothes covering the seat of the fracture, which is best done by ripping the seams, the limb should be wrapped in wadding or soft cloths; over this should be placed splints made from thin pieces of wood, box-covers, cardboard, tin, bark, or any other material that may be at hand (see Figs. 96, 97, 98), and these splints should

FIG. 96. Emergency splint for fracture of forearm.

be tied with strips of gauze, linen, rags, shirt strips, suspenders, etc. If the fracture is a compound one, great care must be taken to avoid infection. An absolutely clean cloth, put in boiling water for ten to fifteen minutes and then wrung out, may be applied tightly until the physician arrives.

Injuries of bones by gunshot wounds and by machinery are shown on Plate XVI., Figs. 3, 4, 5.

FIG. 97. Emergency splint for fracture of the leg.

BONE, INFLAMMATION OF.—As explained in the INTRODUCTORY CHAPTERS, the bone consists of three parts: the compact *bone-mass*, the *periosteum*, and the *bone-marrow*. Inflammation may involve any one of these parts, and is then designated accordingly; or, as is usually the case, all three parts may be affected by a severe inflammation.

Acute inflammation of a bone is generally characterised by a sudden

rise in temperature, with violent pain in the affected bone. A swelling of the soft parts covering the bone soon develops, indicating the beginning of an accumulation of pus in or about the bone. As the skin, muscles, tendons, and periosteum which bar the pus from reaching the outer parts are strong and thick, it gets to the surface very slowly; and, on account of the great tension under which it is put, it causes severe pain. Absorption also takes place, giving rise to the fever.

The inflammation generally produces a purulent affection of the periosteum, varying in extent; and this in turn causes the destruction of a part of the compact bone-mass, which is deprived of nutrition coming through the blood-vessels of the periosteum. The mortified piece of bone (*sequestrum*) gradually becomes detached from the unaffected parts, and is cast off. The

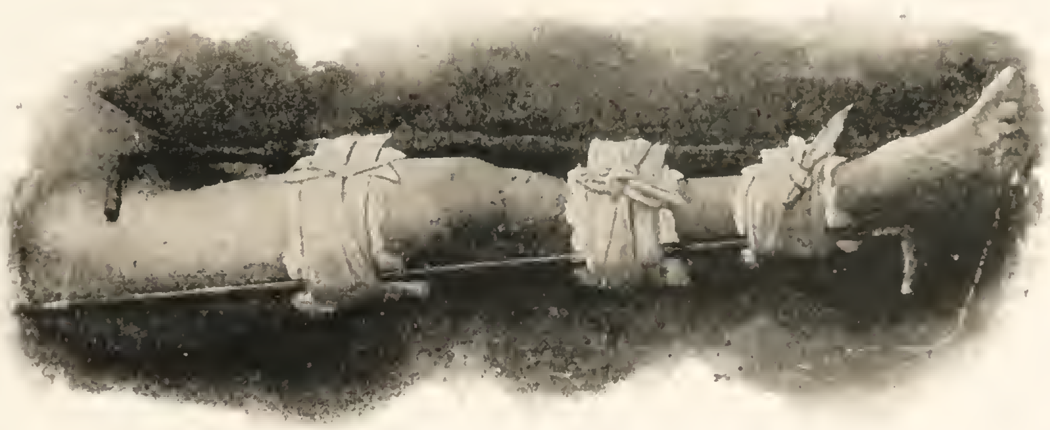


FIG. 98. Emergency splint for a broken bone.

opening of the abscess and the discharge of the pus do not, as a rule, terminate the morbid process, and the mortified piece of bone may remain behind for several months. The discharging pus generally causes a fistula, which remains open until the sequestrum is fully thrown off. At times, however, the dead bone fragment is so large that it cannot pass out through the narrow opening of the fistula; and as it would require a long time for the sequestrum to be disintegrated and discharged, it is better surgery in such cases to remove the diseased part of the bone by operation. In this way suppuration, which is harmful to the general condition of the patient, is arrested as early as possible. Acute inflammation of bone (*osteomyelitis*) is more common in children than in adults.

Chronic inflammation in the bone is generally due to tuberculosis; it develops much more slowly and insidiously, and accumulations of pus are formed mostly without acute pains or high fever. The duration of the disease is also much longer; it may extend over years, or it may even be altogether incurable. As the destructive process advances step by step, continually involving new parts of the bone, the prospects of cure are much more unfavourable than in the acute form. Hence, in these cases operation should likewise be performed as early as possible, and the diseased portion

entirely removed. Chronic hip-joint disease and chronic humpback are diseases of this kind. They are types of localised bone tuberculosis.

BONE, SOFTENING OF.—A condition which occurs almost only in adults, and which is due to a loss of the lime-salts of the bone. The disease, which is comparatively rare, affects women principally. It appears that it is more frequent in southern Germany and in the Rhine Valley than in the northern parts of Germany. It is very common in certain localities in Switzerland, northern Italy, and Austria, but comparatively rare in Great Britain.

The cause and nature of the softening are not thoroughly understood as yet. Among the causes which give rise to the appearance of the disease are, principally, rapidly succeeding pregnancies and long-continued nursing with insufficient nutrition. It is claimed, further, that damp and dark dwellings or bed-rooms, improper food (too many potatoes; sour, black rye-bread, etc.), and occupations which subject the patient to cold and dampness, play a part in the occurrence of the affection.

The first symptom of the disease is pain in the bones involved, mostly in the pelvis. The pains radiate towards the spinal column and thighs, and are at first often taken to be rheumatic. Soon, however, an uncertain, dragging, or peculiarly waddling gait becomes noticeable. Sitting causes pain, and the bones bend. The spinal column, no longer able to carry the weight of the body, curves backward, and, as a result, the patients grow shorter. When the disease has reached a more advanced stage walking becomes impossible, and the patients must remain in bed.

Although the course of the disease is a slow one, it is not always unfavourable. Cessations and even cures have been observed. It is true, however, that the danger of a recurrence and progress of the disease is connected with every new pregnancy. Treatment is not quite as hopeless as it appears. If unfavourable conditions of life are present, they should be abolished. Dark and damp dwellings should be exchanged for bright and airy ones. The diet should preferably consist of foods which are rich in phosphorus and lime, such as eggs, meat, certain vegetables (beans, peas), and cheese. Potatoes must be avoided, and food which contains sugar should be taken only in moderation, but fruit is admissible. Warm baths in the form of sheet packs, with or without additions (salts, brine, herbs), and sun-baths usually act very beneficially. A comfortable resting-place should be provided, with suitable bolsters, water-bags, etc. In addition to cod-liver oil, iron and phosphorus are useful medicines in this disease. Recurrence of pregnancies should be avoided if possible. If the disease progresses in spite of careful treatment, there remains as a last resort CASTRATION, which has given good results. A particular type of bone-softening is seen in children who suffer from RICKETS.

BONESET.—See EUPATORIUM.

BOTULISM.—See Poisoning.

BOW-LEGS or BANDY LEGS.—Legs which are bent in an outward curve (see Fig. 99). They are the result of a curvature of the bones of the thighs and lower legs, usually due to rickets. In very small children, bow-legs may straighten if the cause of the condition (rickets) is treated. In older children, one cannot with certainty count upon straight growth ; and

FIG. 99. Bow-legs or Bandy Legs.

splints must be used to act upon the deformity. Operation, consisting in breaking or chiselling of the curved bones, is necessary only in the most severe cases.

BRAIN.—The chief mass of nervous tissue in the body. In it are connected all of the nervous fibres from the different parts of the body, and it serves as the chief organ whereby the different parts of the body are co-ordinated one with another ; more particularly it has the important function of fitting man to his environment, through the intellectual processes. The brain is an extremely complex organ. It may be likened very crudely, and

in a rough mechanical way, to a telephone switchboard. It is the "Central" for all forms of activity within the body, as well as those in the outside world that may be brought in contact with the body. Through the brain all messages from the outside are received, and from it are issued all impulses to perform the different acts that constitute man's conduct.

The sense-organs of the body are acted upon by the various stimuli in nature; and these, passing through the sensory nerves into the spinal cord, are received by the brain, constituting the unanalysable primary psychic atoms, or elements—the *sensations*. These, in turn, are perceived, recorded, remembered, compared, sorted, etc., and serve to make up *thoughts, ideas, judgments*, etc., varying in complexity, in certainty, and in correctness according to the quality of the brain-material (its fibre connections) and the richness of its experience. As a resultant of these thoughts, ideas, and judgments, *acts* are performed, constituting a third primary division of the functions of the brain. These responses, or acts, may be *voluntary*, the tension of the impulses having passed into the field of consciousness; or they may be *involuntary*, having resulted from reactions between the sense-organs, spinal cord, and muscles (spinal reflexes, sympathetic reflexes); or the involuntary act may, after having been for years a voluntary act (as in walking), by constant repetition cease to be a dominant factor in the field of consciousness (so-called sub-conscious acts).

There is in the brain-substance a certain amount of division of labour, as yet only incompletely worked out. A motor area is known; likewise a sensory one. Areas for the understanding of things seen, heard, smelled, or touched have been localised. General areas in which complex ideas are elaborated are mapped out; but the brain is so infinitely complex that all of the fibre-tracts, cell-groups, and connections will be known only after many more years of painstaking investigation of the human brain as well as of that of lower animals. The mass of known facts, however, fills many thousands of volumes. No one human mind knows more than a very small fraction of all the facts ascertained concerning the brain.

BRAIN, APOPLEXY OF.—A suddenly occurring, and usually extensive, one-sided paralysis, due to the obstruction or rupture of a blood-vessel of the brain.

Obstruction of a blood-vessel is brought about either by coagulation of the blood in an artery of the brain, or by the lodging of blood-clots, formed in one of the large arteries of the body, and carried into the blood-vessels of the brain by the blood-current. The results are the same in either instance: occlusion of the blood-vessel, obstruction to the circulation of the blood, and disturbance of nutrition in the form of a softening of the brain-substance. It is only occasionally that the occlusion is brought about by the morbidly thickened wall of a blood-vessel, which little by little narrows the blood-channel and interferes with the circulation; this is the case, for instance, in

syphilis of the brain. Not infrequently the formation of thrombi is brought about by septic infections, such as typhoid fever or pneumonia, and particularly by acute articular rheumatism.

The rupture of a blood-vessel, with subsequent flow of blood into the brain, is always the result of a vascular affection, which is characterised by calcification and brittleness of the wall of the blood-vessel. This calcification of veins and arteries occurs especially in an advanced age; it is furthered by the abuse of alcohol. The immediate cause of an apoplectic stroke is usually a rush of blood to the head, such as occurs after mental emotions, or after an abundant meal or a drinking-bout. So-called "apoplectic" individuals—that is, broad-shouldered, corpulent persons, with short necks and flushed faces, who are fond of alcoholic drinks, and who often suffer from disturbances of heart and respiration as indicative of an existing disease of the blood-vessels—are more prone to hæmorrhages of the brain.

The symptoms of apoplexy due to obstruction of the blood-vessels do not differ much from those of apoplexy due to hæmorrhage, except in that the latter are generally more severe. An attack is frequently preceded for days, weeks, and occasionally for months by cautioning "forerunners" in the form of headache, dizziness, ringing of the ears, rapidly passing disturbances of speech, and attacks of fainting. The attack proper sets in slowly, or rapidly and violently, according to whether the occlusion of the vessel, or the hæmorrhage, took place gradually or suddenly. In the former case the patient becomes mentally uncertain, dull, confused, and staggering; he loses the use of his arms and legs, and finally complete loss of consciousness takes place, accompanied with usually a one-sided paralysis. In an acute attack, such as usually occurs after severe hæmorrhages, the patient falls to the ground as if struck down, and loses consciousness at once. His face is generally (but not always) flushed, his respiration snoring, and his lips and cheeks drawn in and puffed during breathing; his limbs are without motion, and when raised they fall back, completely relaxed; urine and fæces are discharged involuntarily. In case the hæmorrhage is very profuse and affects a vital part of the brain, death occurs, sometimes at once, sometimes after a few hours or days, without the patient recovering consciousness.

More frequently, however, the patients recover from such attacks. The blood extravasated into the brain is in part absorbed by the lymph-vessels; in part it breaks down or is encapsulated; or it leaves a scar. Consciousness returns gradually, but a one-sided paralysis remains as a result of the destruction wrought in the brain. According to the extent of the damage to the brain-tissue, these paralyses affect larger or smaller parts of the body. They may remain permanently, or they may pass entirely or in part. In contrast to paralysis of the spinal cord, brain-paralysis involves only one side of the body, and always the side which is opposite the site of the hæmorrhage or occlusion; hence a hæmorrhage into the right side of the brain

causes a left-sided paralysis, and vice versa. In severe cases the paralysis may extend over an entire side of the body, involving one-half of the face, one arm, and one leg. Right-sided paralysis (resulting from left-sided hæmorrhage) is usually associated with a material disturbance of speech.

In case the apoplectic attack runs a favourable course, the patients are able after a few weeks again to move their limbs, although only imperfectly at first ; speech also returns. The degree of improvement which may take place in the course of months and years depends entirely upon the severity of the lesion, and in part also upon the correct treatment. In very favourable cases all symptoms recede, whereas in severer ones some muscles remain permanently paralysed or at least impaired in function. The paralysed limbs, especially the arm and the hand, become affected by contractures, as well as by trembling or by movements resembling St. Vitus's dance. The mental capacity of the paralysed persons is frequently affected as well. They may lose their memory, or they may become dull and indifferent ; and they have no conception of the severity of their malady. It is never possible to make a reliable prediction as to the result, the less so as these attacks frequently recur. Slight hæmorrhages (or occlusions of vessels) cause only insignificant disturbances of consciousness, dizziness, ringing of the ears, and temporary weakness in arms and legs.

The best treatment for apoplexy of the brain is the preventive treatment. Persons suffering from heart-disease and old people with changes of the blood-vessels and with apoplectic predispositions should avoid all causes which might result in a congestion of blood to the head. They should lead temperate lives, abstain entirely from alcoholic drinks, and beware of over-exertions of any kind. Very little can be done for the treatment of the apoplectic stroke itself. The patient should be put in bed, with the upper part of the body raised if the face is flushed, and with cold compresses to the head. It may be of service also to place the feet in hot water. The further treatment, especially that of the consequent conditions, must be left to the physician. Alcoholic drinks should be avoided.

BRAIN, CONCUSSION OF. A condition brought about by external force, by a blow, a knock, or a fall. It results in the loss of consciousness and sensation, in vomiting, pallor, retarded pulse, and in superficial respiration. It is often impossible at once to decide whether a fracture of the skull is present in addition to concussion of the brain.

A person who has suffered a concussion of the brain must be moved very carefully and cautiously. It is better, therefore, to have him rest provisionally at the place of accident, by using blankets, rugs, bedding, etc., until suitable means are at hand to move him to a proper place. In the meantime all constricting parts of his dress should be loosened, his head placed in a low position, and any bleeding injuries which may be present should be

attended to. If he is able to swallow, water should be administered. The patient should not be transported in a carriage, but on a stretcher; if a waggon is used, he should be protected from all shock. Specially constructed ambulances are available in large cities. Artificial respiration should not be used. A physician must, of course, at once be summoned to the place at which the accident occurred.

BRAIN, DISEASES OF.—In addition to meningitis, cerebral apoplexy, dropsy of the brain, and softening of the brain, there are other affections of this organ which shall be discussed briefly in this space.

Disturbances of the circulation of the blood in the brain are among the more general causes of disease of that organ. If the blood supply is insufficient (*anæmia*), the patient becomes pale and dizzy, and subject to fainting spells. This condition is brought about by mental emotions, exhaustion, loss of blood, weakness of the heart, and by gastric disturbances (long-continued fasting). Delicate, weak, chlorotic persons are specially subject to this disease, and may suffer also in the intervals from headache, exhaustion, and ringing of the ears. Regarding the treatment of fainting attacks, see the directions under FAINTING. To prevent a recurrence of the attacks, the best course to pursue is to improve gradually the delicate constitution by general hygienic measures.

Congestion, the opposite of anæmia, is the result of abnormal accumulation of the blood in the head. The face becomes dark red, the arteries of the temple throb, and a sensation of dizziness is felt. The patient becomes subject also to attacks of fainting; and even slight, temporary paralytic strokes occur (as in cerebral apoplexy). Mental emotions (as anger) are the cause also of this condition; but excesses in eating and drinking, great heat, and tight clothing are also factors. Patients suffering from congestion should be placed in a quiet position, and with the upper part of the body raised. A cold-water compress or an ice-bag should be placed on the head; a hot foot-bath with simultaneous cooling of the head also diverts the blood downward. General treatment to improve the health must be considered. This includes the prohibition of alcoholic drinks and of food difficult to digest, attention to regular movements of the bowels, avoidance of over-exertions, etc.

Tumours of the brain are of considerable importance. They occur not infrequently in middle-aged persons, oftener in men than in women, and the causes of their origin are but vaguely known. It is often difficult even for a physician to diagnose the affection in its early stages. Indistinct, dull headache is usually one of the earliest signs; other disturbances appear only after weeks and months, and they may vary greatly according to the seat and the condition of the tumour. The symptoms include disturbances of vision (very frequent), dizziness, staggering gait, paralysis or weakness of various limbs, vomiting, a dull stupor, unconsciousness, and loss of memory.

After months, more rarely after years, the disease terminates in death. Only such tumours are curable which may be removed by operation, or which are due to syphilis (see below).

Syphilis of the brain does not, as a rule, manifest itself until a long time (sometimes years) after the syphilitic infection. The symptoms of this disease vary greatly according to whether some syphilitic nodes or a general affection of the brain has developed. One form of cerebral syphilis can scarcely be distinguished from softening of the brain; another occurs as an apoplectic stroke; and a third form presents all the symptoms of syphilis. Recovery is possible if the disease is recognised in time. Children with inherited syphilis of the brain may remain mentally weak.

BRAIN, SOFTENING OF. This designation, as it is used by the laity, does not correspond with the scientific name of a distinct affection, techni-

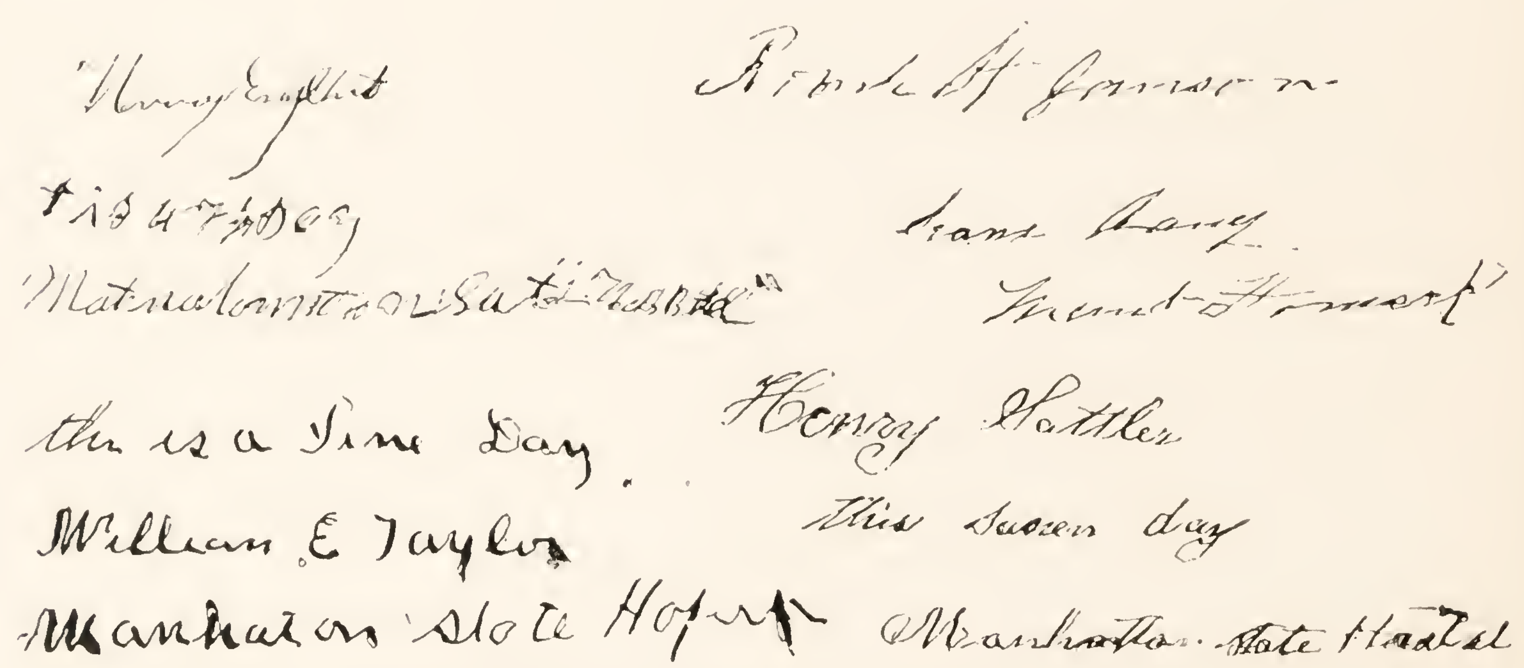


FIG. 100. Handwriting of various paretics. Each specimen contains, besides the name of the patient, the words: "This is a fine day—Manhattan State Hospital."

cally known as general paresis or *dementia paralytica*. It is true there is a genuine softening of the brain-substance (for instance, after a hæmorrhage of the brain), but this is not identical with the disease to which the laity refers. This affection consists in a wasting and destruction of the nerve-elements in the cortex of the brain; and it manifests itself, briefly stated, in a gradual decay of the mental faculties, combined with a weakness of the muscles of the body, which may be increased to loss of their function.

The disease is of great importance for various reasons, primarily because of its frequency. It occurs three to four times as often in men as in women; and about ten per cent. of all demented patients admitted into asylums are paretics. Further, it is prone to affect patients in the prime of life, thirty to fifty years of age. It is almost invariably fatal within a few years, although occasionally temporary improvements simulate a cure for weeks or months. It is particularly important to recognise this disease in its early stages, as the afflicted person often commits foolish or criminal acts.

The following example may serve as an illustration of this: A business man who has always been moderate and capable becomes "nervous"; he does not sleep well, grows irritable and restless, neglects his business, drinks, associates with women, becomes conspicuous by absence of mind, forgetfulness, and "inconceivable" social offences, and he will not listen to well-meant counsel. He is looked upon as overworked and neurasthenic, and he is made to go into a hydropathic institution. There, however, the true nature of his affection soon becomes manifest—his mind deteriorates very rapidly, and he may some day frighten the institute by an attack of mania.

The further course of the disease develops in various manners, but its main feature is always a gradual collapse of the mental faculties. The memory fails, the capacity of judgment is lost, the mentality is dulled, and gradually the patient becomes completely idiotic. It often happens that "delirium with exaltation" develops, which may alternate with hypochondriacal depression. The deterioration of the mind goes hand in hand with that of the body: the faculties of the muscles relax, the gait becomes clumsy, the speech stuttering and babbling, and the writing indistinct and trembling (see Fig. 100). Slight paralytic attacks resembling epilepsy occur occasionally, but the patient usually recovers from them; finally, the condition is intensified by the supervention of paralysis of the muscles involved in swallowing, and failure of the muscles of the rectum and of the bladder. The patient, now helpless as an infant, dies with the symptoms of the most complete exhaustion, provided pneumonia or another affection has not previously terminated his unfortunate life.

The principal cause of paresis is syphilis, which has been either neglected or insufficiently treated. In some cases the paretic condition does not appear until ten years or more after the syphilitic infection, and generally when other injuries of the nerves (caused, for instance, by the abuse of alcohol) are added. There can be no doubt that also non-syphilitic persons are affected by the disease, although far more rarely. Heredity also plays a part, but less so than in most of the other mental diseases. Paretic patients are always best taken care of in an institution, private or public.

BRAN-BATH.—This is prepared by adding a decoction of 2 to 6 pounds of wheat-bran to a full bath of a temperature of 95° F. The decoction is obtained by boiling the bran in a linen bag, and the extraction as well as the boiled bran are thrown into the bath. The bran-bath acts soothingly, and is therefore of service in conditions accompanied by itching of the skin.

BREAD.—An article of food which may well be designated as the staff of life. The important position accorded to this substance is well merited, for it contains the most important elements of nutrition required by the body, namely proteids and carbohydrates; it furnishes in abundance the salts which are necessary for the building up of the body and for the maintenance of good health; and in many instances it serves as a means of

rendering other nutrient substances available or palatable. The carbohydrates predominate in bread, while meat, on the other hand, is the type of an albuminoid food. The more common varieties of bread are composed of the following constituents:

Bread made from High-grade Flour	Water Per Cent.	Proteids Per Cent.	Carbohydrates Per Cent.	Fat Per Cent.	Ash (Salts) Per Cent.
Low proteid bread ..	30·0–33·0	7·0–7·5	55·0–60·0	0·8–1·0	0·5–0·8
Medium proteid bread	32·0–34·0	9·0–10·0	55·0–60·0	1·0–1·5	0·8–1·0
High proteid bread ..	34·0–36·0	10·0–12·0	50·0–53·0	0·7–1·0	0·4–0·6

The amount of fat in bread varies widely according to the richness in cream of the milk used or the amount of lard or butter incorporated. Breads made from bolted wheat (white flour), from entire wheat, or from whole kernel (Graham flour) will also vary in their percentage of proteids and other ingredients. Thus, chemical analyses show the general differences in these flours as follows:

—	Proteids Per Cent.	Carbohydrates Per Cent.	Fat Per Cent.	Ash (Salts) Per Cent.
Graham flour	12·0–13·0	74·0–75·0	2·0–3·0	1·0–2·0
Entire wheat	12·0–12·5	73·0–74·0	2·0–2·5	1·0–1·5
White flour	10·0–12·0	75·0–76·0	1·5–2·0	0·5–1·0

Bread which has been prepared with milk contains a much larger proportion of proteid materials. This is true not only on account of the flour, but also because the milk employed constitutes an important factor in supplying food-elements. Among the breads prepared with flour and water only, the variety known as Graham bread contains the largest quantity of proteids, because, in addition to the flour, there is a considerable amount of gluten present, which contains the greater part of the proteids of the grain. These are more or less concentrated in the outer coverings, which are discarded in the ordinary processes of milling white flour; and the more starchy elements, situated in the centre of the grain, predominate in the flour. A comparison made between the chemical composition of the different varieties of bread and the various kinds of flour shows how great the loss of proteids may be when the gluten is not employed.

—	Wheat	Rye	Barley	Oats	Corn	Rice
Proteids (per cent.)	12·35	11·52	11·14	10·41	9·25	7·85
Carbohydrates (per cent.) .. .	67·91	67·81	64·83	57·78	68·41	76·52

Bearing in mind the great nutritive value of the proteids, it would seem a very wasteful procedure to discard the gluten in baking; the digestive processes, however, not only excuse this waste, but as a matter of fact

demand it. For to many people the outer coverings of the grain act as an irritant to the intestines ; and, although these special breads may serve as dietetic agents and gentle laxatives, they do not necessarily aid the digestion, but may produce disturbances of this function, particularly in susceptible individuals. The irritation set up in the intestines does not permit the ingested food-material to remain in the gut sufficiently long to become fully absorbed, so that it may be quite fairly stated that gluten-bread represents a very wasteful article of food, and that the finer varieties of bread must be looked upon as more suitable nutriment. So long as no process has been discovered by which the gluten may be separated from the outer shell of the grain in making flour, it is considered wiser by some to employ it as fodder for animals, where a suitable mode of digestion is provided for this purpose, rather than to incorporate it into bread in the belief that it increases its nutrient value.

The great differences in the percentages of nutrient substances in the various grains and their products when made into bread is due not only to the loss of proteids in the gluten, but is largely brought about by falsely conceived methods of baking. Bread must be light in order that it may be properly attacked by the digestive juices. By the aid of fermentation the starch-cells are ruptured, and may thus be more readily acted upon. When this is accomplished by the addition of leaven, the process consumes about 20 per cent. of the nutritive value of the bread—a very considerable loss. It is essential, therefore, that the ordinary methods of baking be abandoned and that Liebig's principle be more fully recognised, which prescribes, instead of leaven, a baking-powder mixture of an alkaline carbonate and an acid. In the baking of cake and pastry this recommendation has long been followed, and, in addition to the use of yeast for this purpose, there are now a number of very efficient baking-powders on the market. As the dough rises, it may result in the formation of scattered areas in which no fermentation has taken place, and which prove an obstacle to digestion. These should not be eaten ; nor is it advisable to eat much hot bread, for the latter undergoes further fermentation in the stomach, and may cause a great deal of distress. Persistent eating of hot bread and biscuits may even lead to gastric catarrh.

BREAST, CANCER OF.—An affection which occurs not only in older women, but also in those who have not yet reached middle life. Usually the patient's attention is directed to the condition by finding a hard nodule in the breast, which may or may not be painful. The discovery is very often accidental. A cancer of the breast rapidly invades the axillary glands and may lead to secondary deposits also in other parts of the body, such as the lungs or the bones. Every hard nodule in the breast should at once be submitted to the inspection of the physician, and if operation is recommended his advice should be followed, for cancer in the breast may be cured by a

surgical operation. The earlier this is done, the more favourable are the prospects of a permanent cure. But even in those cases where the growth has already involved the axillary glands, a cure may yet be possible. It is necessary in such cases not only to remove the affected breast, but also the axillary glands of the affected side. After operation it is desirable that the patient submit to regular subsequent examination by a physician, so that any recurrence may be detected and removed as soon as possible. This greatly enhances the chances for permanent relief.

For the reason just stated it cannot be too firmly impressed upon the lay mind that the employment of any of the numerous popular or secret nostrums is waste of very valuable time, the remedies themselves being absolutely ineffective. The so-called natural methods (air, light, water, etc.) are likewise worthless, and have never yet succeeded in curing the disease. A person should never be misled by the claims made for these methods nor by the publication of pretended cures. In the presence of true cancer, the only way to eliminate the growth is by early and thorough operation. Too much faith must not be placed in the X-ray treatment. Although useful in some cases of flat cancer, the X-ray treatment is generally useless in deep-seated carcinoma of the breast.

BREAST, INFLAMMATION OF.—A condition which is essentially the result of the resistance offered by the body against bacteria which have invaded the glandular tissue of the breast. In order to combat this invasion, the organism sends an increased amount of blood to the part, causing, as a result, pain, swelling, local heat, and redness. This reparative effort may be sufficient to overcome the bacteria and render them harmless. If in any given locality the bacteria gather in preponderating numbers, the leucocytes, or white-blood-cells, leave the blood-channels in hordes and literally devour the offending invaders. This process results in suppuration and abscess formation, and the further advance of the bacteria is halted by a surrounding wall of inflammatory tissues. Minute collections of pus scattered among the tissue-spaces may be entirely absorbed by the lymphatics. As the bacteria, in addition to their local destructive action, also produce toxic substances which are taken up by the system, severe general disturbances may be observed from the very first. These consist in increase of temperature and pulse-rate, and in more or less marked prostration. These symptoms are especially severe, because the blood and lymph vessels, particularly in the breasts of nursing mothers, are well developed and considerably dilated, wherefore the toxic materials are taken up by the system in large amounts. When there is a constantly increasing collection of pus in any one locality, the surrounding tissues become separated, or may even be destroyed. In this manner the abscess gradually works its way to the skin, and finally breaks through the latter. This process may be hastened by the application of hot poultices, mustard-plaisters, etc.

In addition to the general symptoms already noted, there are those due to the local process, similar to those from any other inflammation: local redness and heat and a gradual loss of function, the milk giving out, although the breasts are tense and apparently distended. The temperature may rise to 104°F. (40°C.) or more, but this does not seem to be of any great moment. Life is endangered only in exceptional instances, where there is a very virulent infection in the presence of lowered vitality and consequent diminished resistance in the patient; or where some method of treatment has been employed which retards rather than aids the natural process of resolution.

Unfavourable conditions and neglect in giving the trouble proper attention may lead to very extensive suppuration of one gland, with involvement of the second, so that nursing is not only entirely interrupted, but the mother's recovery may be protracted for weeks and months. When suppuration has once begun, it can with difficulty be retarded; but it is possible to restrict the inflammation in the early stages by the continued application of cold, which must be done under the direction of the physician. As soon as pain and discomfort is observed during the period of nursing, medical advice should be sought at once.

It is, however, even more important to avoid the possibility of this trouble. The points of entrance for the infectious organisms are usually small cuts and tears on the tender skin of the nipples, which give rise to a burning pain when the child is given the breast. Under these conditions the child should be nursed only with the aid of a nipple shield. If the sensitiveness continues, even after the application of alcohol, antiseptic solution (boric acid), or other cooling lotions, nursing from the affected breast should be stopped at once. The physician had better be called in consultation, especially if portions of the breast have become red and tender. The abrasions are often hard to find; nevertheless bacterial contamination may readily take place from contact of the wounded nipple with the underclothes, from the mouth of the infant while nursing, or from being touched with dirty fingers. The cloths used for the antiseptic applications should be changed every half hour; if adherent they should not be pulled off roughly, but only after being thoroughly wet. The manner of avoiding the production of these abrasions and subsequent infection will be found fully described in the article on NURSING.

Inflammations of the breast also occur in infants. The glands may swell to the size of a walnut, and become red and tender. Suppuration rarely follows, such as that which in adults leads to deformity of the nipple and inability to nurse properly. In these cases the inflammation should also be treated from the very beginning with antiseptic applications. In no case should the inflamed gland be subjected to pressure The infectious organisms usually reach the interior of the little ducts in the nipples either

during delivery, when there is a contagious vaginal secretion present, or later on from uncleanliness.

BREAST, PAINFUL AFFECTIONS OF.—Severe cutting and pricking pains sometimes noted in the breasts of nervous women. The mammary glands of these patients are not apparently affected by any organic disease. The pain may become almost unbearable and cause considerable mental anguish, the patients being falsely led to believe that they are afflicted with cancer. In many instances the pains may be made to disappear quite rapidly by a simple mechanical procedure: The patient takes the breast, which is usually very much relaxed, with both hands, and stretches it like a rubber ball in both directions, particular attention being given to the tender areas. This is continued until the entire gland has been manipulated, and may be repeated as often as necessary. The procedure is not very agreeable, but the results are gratifying. Later on the breast may be covered with hot applications or wrapped up in cotton.

BREAST, TUMOURS OF.—Tumours, both benign and malignant in character, may be found in the female breasts. Inflammatory processes, like tuberculosis, also give rise to tumefaction. Benign tumours are removed readily and without danger by a simple operation. It is imperative to consult a physician at once on the appearance of the first evidences of a tumour in the breast, and let him decide whether it is benign or malignant. See also Breast, Cancer of.

BREATH, FOUL.—A condition which generally results from disease of the mouth, especially of the teeth. Some of the causes are decayed teeth, inflammation of the gums, and artificial plates which are not kept clean. Regarding treatment, see Teeth, Care of. When the mouth of a very sick person smells, thus affecting his appetite, it is very important to cleanse it thoroughly by brushing teeth, gums, and tongue. Foul breath may be caused also by abnormal conditions of the cavities of the nose and upper jaw, by diseases of the windpipe with malodorous discharges, by diseases of the throat, stomach, intestine, and urinary organs, and also by anæmia and diabetes. Disease of the mouth, however, is most frequently responsible for the condition. In addition to treatment of the fundamental trouble, a refreshing mouth-wash will prove beneficial.

BREATH, SHORTNESS OF.—Under normal conditions the adult male draws 16 to 18 breaths per minute; the adult woman, 18 to 20. New-born children breathe 40 times and more per minute; young children, 25 times per minute. Disturbances of the frequency of breathing and of the depth of the individual respirations occur in so many morbid conditions of the air-passages, and also of other organs, that it is only exceptionally that they may serve to indicate the nature of the existing disease.

The respirations increase in number after every mental, and especially after every bodily, exertion; in short, after conditions which increase the

activity of the heart. The increase may be said to be morbid if painfulness exists in any part of the body which is put in motion by respiration (as in pleurisy, fracture of a rib, rheumatism of the muscles of the chest, inflammation of the abdomen, etc.). Increased respiration is brought about by any febrile condition, and most particularly by affections which interfere with the exchange of gases in the lungs. This is true whether the passages through which the air enters the lungs are narrowed (as in bronchitis or asthma) or whether the pulmonary vesicles in which the exchange of gases takes place are impervious (as in pneumonia). Narrowing of the air-passages may occur in any individual part of the respiratory canal, from the nose to the finest branches of the bronchi, being caused by such diseases as tumour of the nose, swelling of the tonsils, goitre, croup, diphtheria, severe affections of the larynx, and swelling of the mucous membrane of the bronchi. Impervious conditions of the pulmonary vesicle are brought about by pressure upon the lungs (in consequence of fluid, air, or tumours in the pleural cavity), by filling of the pulmonary vesicles with fluid or semi-solid masses (in inflammation and dropsy of the lungs ; and in cheesy disintegration of the pulmonary tissue), or by loss of the elasticity of the pulmonary tissue, which causes it to be less expansible as well as less contractile (as in emphysema of the lungs).

The greater the diminution of the respiratory surface, and the more rapidly this diminution occurs, the more marked becomes generally the shortness of breath. The increase of the obstacle to respiration causes the blood to become poorer in oxygen and richer in carbon dioxide gas ; and the overcharging of the blood with the latter poisonous element irritates the respiratory centre in the medulla oblongata (that is, the collection of nerve-cells governing the function of respiration).

Shortness of breath may result from certain affections of the heart, which cause an over-abundance of blood to be conveyed to the lungs. It may be present also in diseases of the abdominal organs if such organs become enlarged sufficiently to force the diaphragm upward, or to impair its ability to contract. Obstructions to respiration usually cause an increase, rather than a decrease, in the frequency of breathing. A decrease occurs when the larynx and the windpipe are narrowed (as in croup or diphtheria), or when an affection of the brain develops in the course of diseases of the lungs. Shortness of breath shows a peculiar character in asthma and in spasm of the glottis.

BRIGHT'S DISEASE.—See Kidneys, Diseases of.

BRONCHITIS (BRONCHIAL CATARRH).—Inflammation of the mucous membrane of the bronchi and their branches. The disease may occur as an acute or as a chronic affection ; it may implicate one side or both ; it may affect either only the larger or only the finer ramifications of the trachea ; or it may involve the entire " bronchial tree " (see Fig. 52).

The most frequent causes of bronchial catarrh are colds (caused by sudden cooling of the heated body, by drenching, or by the breathing of cold, damp air), and the inhalation of dust, smoke, or gas. Noxious gases are especially dangerous. The fumes of nitric and sulphuric acids, the vapours of bromine and chlorine, and the dust of vegetable detritus are all injurious. Mineral and metallic dusts, including those which, owing to their sharp points and rough surfaces, greatly irritate the mucous membrane, and in part even directly injure it, are even more to be avoided. Certain trades, such as the stone-cutter's, carpenter's, miller's, baker's, paperhanger's, turner's, and file-cutter's, are dangerous because of the contact with dust. Experience also shows that children, the aged, and persons affected with scrofula or with diseases of the heart or lungs, are much more liable to be attacked than thoroughly healthy persons in the prime of life.

Acute bronchitis occasionally sets in with a sudden rise of the temperature of the body, even with a violent chill. In many cases, however, it is entirely free from fever. If the affection is very severe, the general condition is also impaired. The most essential symptoms are cough and expectoration. The patients continually have the sensation of tickling in the throat and of soreness behind the upper part of the breast-bone, sometimes along the entire breast-bone ; they are tormented by an annoying irritation to cough, without, however, being able to expectorate much, at least not in the beginning. A so-called dry cough is present. The accumulation of viscid mucus in the bronchi causes, upon the passage of the respired air, the occurrence of humming sounds in the chest, which are often noted by the patient, and even some distance from him. So long as the cough is painful, and the sputum can be expectorated only with difficulty, the sleep of the patient is impaired. Solely as a result of the exertions to cough, and the consequent rush of blood to the head, there arise headache, a sensation of vertigo, nausea, and even vomiting. After a few days the sputum, which at the onset was viscid, mucous, and thread-like, usually becomes more fluid, mucopurulent, and sometimes altogether purulent. This causes the cough to become easier—more moist ; the catarrh is looser. Pains in the chest, which generally are present only in the more severe cases of bronchial catarrh, are not caused by the affected mucous membrane of the bronchi ; they are due to over-exertion of the diaphragm and of the muscles situated between the ribs, in consequence of violent paroxysms of cough.

If the catarrh becomes localised in the finer branches of the bronchi, it is followed almost regularly by fever, and the respiratory disturbances may be marked. In children and old persons the affection may implicate the lungs (*bronchopneumonia*), where it will form scattered areas of inflammation, thereby endangering life, especially in small children. The milder forms of an acute bronchial catarrh generally take a favourable course, and

disappear in a week or two ; even the most severe cases usually terminate in cure if carefully treated.

Chronic Bronchitis either develops as a chronic condition from the beginning, or it results from recurring, especially neglected, acute attacks. Its most frequent cause is the continued inhalation of dust, particularly in industrial concerns where much dust is present. Affections of the heart, of the blood-vessels, and of the lungs, may lead to congestions in the blood-vessels of the lungs, and thereby to chronic catarrh of the bronchi. The most essential symptoms are also in this case cough and expectoration. The cough is obstinate, particularly in the morning, evening, and night, and may cause nausea and even vomiting. Some patients have little or no sputum ; in others there are expectorated small quantities of viscid, mucous sputum. Many patients bring up profuse masses of a thin, watery mucous or mucopurulent matter. Slight traces of blood may be found in the expectorated matter, without pulmonary tuberculosis being present. If the chronic catarrh spreads to the finer ramifications of the bronchi, respiration will become impaired.

The course of the affection varies. The condition greatly improves during the warm season, and becomes aggravated during autumn and winter, when new harmful influences are active. If the disease persists for many years, there is danger that a dilatation of the lung-vesicles may occur, and that enlargement of the heart may develop.

The best preventive against bronchial catarrh is to avoid carefully all harmful influences which are known to produce the condition or which favour its occurrence. Rooms which are filled with dust, smoke, or irritating gases should be avoided, and a healthy, dry place of residence selected. The hardening of the skin to the influences of variations of temperature is of inestimable value. See HARDENING.

Although experience teaches that acute bronchial catarrh usually runs a favourable course, it should be borne in mind that this is still more the case if the affection is carefully treated. If fever develops, much time may be saved, and much suffering avoided, by remaining at home, preferably in bed, and securing the advice of a medical practitioner. The majority of people live in hopes that Nature will cure " such little colds," and sometimes they believe they overdo matters by taking hot drinks and getting into a perspiration. Such domestic remedies are often sufficient to check a mild, beginning bronchitis, but in many cases they fail ; and it is rarely wise to assume the responsibility, especially when children or elderly people show the manifestations of bronchial irritations.

The treatment of chronic bronchitis often presents many difficulties, particularly when the patient is unwilling or unable to withdraw from the harmful influences which caused the affection, or which are aggravating it. The prospect of ultimate recovery is present only if the patient leads a

fitting, rational life. The irritants to be feared and to be avoided are smoke and dust, alcohol and tobacco. A change of residence is often advisable. A sojourn in the health-resorts along the south coast is often helpful, not because remedies are to be obtained in these places which are not available elsewhere, but because many patients only in this manner will be able to enjoy a perfect bodily rest, away from the harmful influences that prevail at their homes. The actual treatment should be left to the physician, since it is not always merely a question of combating cough and expectoration; the main thing is often to cure or alleviate the original disease which causes the cough (such as heart defects, kidney diseases, gout, and alcoholism). If these causative affections can be improved, the result is usually an essential recovery from the bronchitis.

BRYONIA.—The dried root of *Bryonia alba*, a cucumber-like plant growing in Europe. The root contains one or more active glycosides, which are extremely bitter, and which have a very active cathartic action. Bryonia has been used as a cathartic from time immemorial. It causes copious, watery stools; and in large doses poisoning with violent abdominal pains, sweating, reduction of temperature, and death from collapse.

BUBO.—An inflammation and enlargement of the inguinal glands, brought about by the entrance of infectious substances into the lymph-channels. They manifest themselves as painful tumour formations in the groin, and follow contaminated wounds and injuries of the lower limbs, or more especially certain sexual diseases, primarily soft chancre, gonorrhœa, and simple inflammation of the prepuce. Non-painful swellings in the region of the groin occur in cases of hard chancre. See Venereal Disease. The swellings of the glands of the groin in soft chancre show a decided tendency to suppuration. It is possible that these may recede, if the patient remains quiet and applies cooling poultices; but if suppuration and softening have occurred, perforation takes place at one or several points in the external skin (formation of fistula), unless an operation be previously performed.

If the condition is still further neglected, especially in weakly and scrofulous persons, numerous fistulous ulcers form which undermine the skin and are difficult to heal. The fistulous canals which penetrate the skin in several places discharge a thin, putrid pus. If surgical aid is not rendered, the continued suppuration and the loss of substance connected with it lead to a long-lasting sickness which, in the course of time, will exhaust the strength of the patient.

Prevention of swelling of the glands of the groin is best accomplished by a corresponding hygienic conduct in the existing inflammatory affection responsible for the condition; above all, by rest and scrupulous cleanliness, and by the earliest possible diminution of the infectious character of a

venereal ulcer by medical treatment. A painful inflammation of the inguinal glands once being present, the patient should keep quietly in bed, and apply cooling poultices until the physician arrives. After softening has set in, it is advisable to lance the swelling as early as possible. If necessary, this should be followed by extirpation of the affected glands, as this will essentially shorten the course of the disease and prevent further complications. The application of bread-poultices, ointment-bandages, etc., often practised after the ulcers are opened, is very inadvisable.

Attention may finally be called to the fact that, in soft chancre, it often occurs that there arises at the site of the opened bubo a new, large, chancrous growth (chancrous bubo), which sometimes destroys extensive portions of the skin. The surest preventive against this disagreeable consequence is energetic, operative treatment, consisting in extirpation of the affected lymph-glands.

BUBONIC PLAGUE.—See Plague.

BUCHU.—The leaves of a species of *Barosma*, derived from South-African shrubs. The active principles are volatile oils and resins with an active glycosid, *barosmin*. Buchu is widely used as a stimulant for the mucous membrane of the genito-urinary tract, and has been employed for many years in the treatment of subacute cystitis, prostatitis, and chronic specific urethritis. It is a very disagreeable drug to take, and cannot be recommended on the ground of its palatability.

BURNS.—Injuries caused by contact with fire, hot objects, molten metals, hot water or steam (*scalding*), or acids or alkalies (*cauterisation*). Distinction is made between slight, medium, and severe burns ; or burns of the first, second, and third degree. Burning appears either as reddening of the skin (first degree), blister formation (second degree), or as charring of the skin (third degree).

The treatment of injuries sustained by burning varies according to the degree of severity. For reddening of the skin, it is sufficient to powder the affected parts with flour, talcum, zinc oxide, or starch ; or to apply olive-oil, fat, white of egg, vaseline, or lanolin. If blisters are present they should be left unopened, and ointment of boric acid or of zinc oxide applied in order to alleviate the pain by excluding the air. The injured parts should be covered with a quantity of cotton, secured with a bandage. Applications of cold water should be avoided, as they tend to increase the pain. In every case of burning, and especially in the medium and severe forms, it is necessary to consult a physician, inasmuch as severe inflammations and lasting suppurations may arise from continued unskilled home-treatment. Severely burned persons must be put in charge of a physician or a hospital without delay. In case of cauterisation of the skin by acids (nitric, sulphuric, carbolic, etc.) the injured parts should first be washed with water, whereupon soda, green soap, chalk, or lime-water should be applied ; for burns

from lime or alkalies (soap-lyes) copious quantities of vinegar and water should be used as a wash.

If a person's clothing catches fire, throw a blanket, a rug, or any article of clothing over him, and roll him in this covering on the floor in order to extinguish the flames. Then pour water over him, and cut his clothes from him with a sharp knife or a good pair of scissors. If the burned person is thirsty he should be given warm water to drink.

BUTTER.—An article of food usually prepared from cream derived from milk which has been allowed to stand for some time. Such cream contains about 25 per cent. of fat, while that obtained from freshly-drawn milk contains only 3 to 3½ per cent. The best butter is made from cream obtained by centrifuging, a method much in vogue at the present day. In order to preserve the butter, salt is added, but in this way the delicate taste of sweet butter is entirely lost. The composition of good butter is as follows: water, 6 to 18 per cent.; casein, ½ to 3½ per cent.; fat, 80 to 95 per cent.; and salt up to 6 per cent.

Substances productive of harm, which are found in milk, are present also in butter; and a large number of bacteria, including those of tuberculosis and typhoid, have been found in that product. It would, however, be ridiculous not to eat butter for this reason, since these germs of themselves do not necessarily cause disease; the body must be in a condition favourable to permit them to multiply. It is important to avoid the possible harm resulting from the ingestion of rancid butter; this condition can readily be detected by the sense of smell because of the evolution of free butyric acid. Light and air both hasten the process of decomposition, for which reason a dark and cool place should be provided for storing the supply of butter. If it is desired to store butter for a prolonged period, it is necessary to free it from all water and casein by melting, and then to add from 1 to 3 per cent. of salt. The latter product melts at 58° F.; pure butter anywhere from 55° to 66° F.; and artificial butter at between 40° and 55° F. The manner of distinguishing artificial butter, or oleomargarine, from natural butter is otherwise very difficult; for in the highly developed processes of manufacture, even the taste of the pure butter is cleverly imitated. Some information may be gained by melting the butter and noting the character of the foam and the sediment. In rubbing good butter between the fingers there should be an absence of all grittiness, and it should not afford the sensation of being greasy or mushy. Rancid butter may be improved by kneading it with milk or buttermilk.

In addition to the adulteration of butter by the incorporation of other fats or of too much water, mention may be made of the otherwise harmless methods of colouring this product with certain preparations. This would undoubtedly be stopped at once if the public would accustom itself to look for dark butter only during the grazing season, and not at other times of

the year to see any disadvantage in buying butter which is light in colour on account of the dry fodder given to the cattle.

C

CACAO (COCOA).—A brown powder which is obtained by roasting and grinding the oval beans of the cacao-tree (*Theobroma cacao*), a native of the tropics, especially of tropical America. The beans are embedded in the cucumber-like fruits of the tree. The cacao-mass contains the following constituents, the quantities varying according to its origin: Fat (cacao-butter), 45 to 49 per cent.; starch (carbohydrates), 14 to 18 per cent.; proteids, 13 to 18 per cent.; theobromine and caffeine, 1·2 to 1·5 per cent. Hence cacao is a food as well as a cerebral stimulant. It is a food because of its contents of fat, starch, and proteids, and a cerebral stimulant by virtue of the alkaloids (theobromine and caffeine) which it contains. The percentage of cerebral stimulants in cacao is less than in tea or coffee; and from this standpoint cacao is therefore less injurious than these.

Divested of its fat cacao becomes less nutritious but more readily digestible, the cacao-butter being digested with considerable difficulty. Most of the cacaos on the market have had a certain percentage of their fat removed, and it is therefore necessary, when they are prepared for drinking purposes, to add milk or cream in order to impart a sense of richness to the beverage. Cacao, with the addition of sugar and a flavour, usually vanilla, constitutes chocolate. The cacao-butter is widely used as a basis for suppositories and pomades.

CADAVER POISONS.—The activity of putrefactive bacteria causes in the dead body a process of decomposition which ultimately breaks down the body-tissues. This process develops chemical substances which are very poisonous (*i.e.*, causing inflammation) to the tissues of the living body if brought into too close contact. The uninjured skin protects against these substances, but persons who handle dead bodies (undertakers, medical students, taxidermists, etc.) should exercise great care that they do not get infected through scratches, abrasions, or small wounds which had remained unnoticed.

CADE, OIL OF.—A thick, ill-smelling oil distilled from *Juniperus oxycedrus* and widely used as a stimulant application to chronic affections of the skin, particularly in chronic, dry, scaly diseases, as eczema and psoriasis.

CAFFEINE.—An alkaloid characteristic of coffee, and also found as caffeine, or a slight modification, in a number of substances used as beverages, notably tea, cacao, guarana, Paraguay tea, etc. It is particularly noteworthy in that it is chemically a *xanthin*, an ammonia alkaloid, and it is related to a number of similar products found in meat. Physiologically it is interesting because of its action on the nervous system. It stimulates

the cerebrum, causing wakefulness and an increased facility for work. It also has a stimulating action on the heart and blood-vessels, and causes an increased flow of urine.

CALCIUM.—A widely distributed element, occurring most commonly in limestone as calcium carbonate. It is an important constituent of the bones and teeth, forming the inorganic basis of these structures. The effect of an insufficiency of lime-salts in the bones is shown in the bony deformities which occur in RICKETS. Probably the most common form of calcium employed in medicine is chalk, used in chalk mixture for diarrhœa. Chalk is a calcium carbonate made by chemical action on the shells of various molluscs. It is a soft, white substance, insoluble in water, and having an earthy taste. Chalk is one of the remedies often given for watery diarrhœa, because it has a slight astringent action and tends to overcome intestinal acidity. The dose of the compound chalk mixture is about a teaspoonful. Lime-water, a very weak solution of calcium hydrate, is also frequently used as an antacid.

CALOMEL.—Mild mercurous chloride ($Hg_2 Cl_2$), one of the most important of the mercury compounds used in medicine. It is used in a vast variety of ways, but chiefly in vapour form, by sublimation, for the treatment of syphilis; and in its powdered form, usually triturated with sugar of milk, for internal use. Calomel, like all of the mercury salts, is an irritant, but being almost insoluble its irritating action is slight, or long delayed. It is used as a stimulating dusting-powder in many chronic skin-affections, and also in many chronic forms of keratitis. Internally it is used in the treatment of syphilis, but more often as a cathartic. Being irritating it stimulates the muscular movements of the alimentary canal, and thus empties the intestine, usually in from 6 to 8 hours after taking. It stimulates the gall-bladder also, and thus aids in emptying this viscus; but it has not been proved that it has any specific action on the secreting power of the liver-cells, notwithstanding the wide belief in the power of calomel to "stir the liver."

Calomel is particularly valuable as a cathartic, as it clears the intestine of its contents; and, by causing an increased discharge of bile from the gall-bladder, it adds an additional amount of that important secretion to the intestinal contents. This is particularly valuable in that condition known as "biliousness," in which the mild catarrhal inflammation of the duodenum, spreading to the biliary passages, tends to limit somewhat the discharge of bile into the intestines.

CALUMBA.—The root of an African vine, *Jateorhiza palmata*. It contains a neutral body, *calumbin*, the alkaloid *berberin*, and *calumbic acid*. It is used only as a bitter tonic; and by reason of its not containing any tannic acid it is frequently combined with iron in the treatment of the secondary anæmias.

CAMPHOR.—A compound obtained from the wood of the camphor-tree, *Cinnamomum camphora*, a large evergreen tree growing in China and Japan. It is a whitish, translucent substance, having a peculiar strong odour and a burning taste. It is very slightly soluble in water, but is easily dissolved in alcohol. It is exceedingly combustible, and is so volatile that it will entirely disappear if left exposed to the air for any length of time. Locally camphor acts as an irritant. Its systematic effect is stimulation of the nervous system and of the heart and respiratory apparatus. An overdose irritates the alimentary canal, causing burning pain in the abdomen, with nausea, vomiting, and purging. The systematic effect will be shown in headache, dizziness, buzzing in the ears, and excitement, followed by delirium and convulsions. The patient may be brought into a state of collapse, with a weak, running pulse, shallow respirations, and cold, clammy skin. Fatal poisoning by camphor is, however, very rare.

Camphor is used externally in the form of a liniment for bruises and sprains, or to relieve the pain and stiffness of rheumatic joints. Internally it is commonly used in cases of nervous depression, headache, and painful menstruation. It is a valuable remedy in hiccup. If taken in the early stages of a cold in the head, camphor will give much relief, and may even abort the attack. It is sometimes used in intestinal flatulence and diarrhœa. Spirits of camphor is given in doses of about 20 drops.

CANCER (CARCINOMA).—See TUMOUR.

CANNABIS INDICA (INDIAN HEMP).—The flowering tops of the female plant *Cannabis sativa*, indigenous to tropical climates, but largely obtained from India and Egypt. This drug has a peculiar effect on the nervous system, and for centuries past it has been largely used as an intoxicant in parts of Asia and Africa. It is either smoked or drunk or eaten as a confection (the *hashish* of Monte Cristo). The active principle is contained in the resinous substance termed *cannabin*.

The effects of the drug vary considerably in the various individuals taking it. After a large dose there is usually a period of exhilaration, during which the individual feels unaccountably happy and is impelled to do and say foolish things. He may have visions of extravagant splendour, perhaps coloured by sensual impressions, particularly if he is of an impressionable temperament, and the scope of his imagination knows no bounds. At other times these hallucinations are of a depressing nature, or such as to inspire him with fear and horror. He does not become unconscious, and usually recognises the unreal character of his dreams. A peculiar characteristic of this condition is the loss of the sense of space and time, so that minutes seem hours and hours weeks, the clock ticking at absurdly long intervals. This is probably caused by the tremendous activity of the mind, thoughts flashing along through consciousness with great rapidity, but with little or no sequence. Power to appreciate pain is lessened or lost.

Periods of unconsciousness supervene, during which the patient may be aroused ; and he finally falls into a deep sleep, upon awakening from which he often feels some nausea and malaise, similar to the symptoms which follow indulgence in opium and most of the other narcotics. This sleep may occur without preceding excitement or unusual sensations. The immediate effect of the drug is not deleterious, but its prolonged use causes dementia. Cannabis Indica is used as a sleep-producing remedy in nervous exhaustion or in sleeplessness due to pain. The dose of the tincture is about twenty drops.

CANTHARIDES (SPANISH FLY).—A beetle, the *Cantharis vesicatoria*, which is found in southern Europe. It is a violent irritant, and is principally used externally to produce a blister. Internally it is sometimes used for its stimulating effect on the urinary tract, but it is uncertain and dangerous. Poisoning by cantharides causes nausea and vomiting, violent pain in the abdomen and kidney region, and a burning sensation in the bladder and urethra, with frequent and painful attempts to urinate. The urine, which is bloody, is at first diminished in amount and finally suppressed. Small particles of iridescent wing-sheaths found in the vomit, show conclusively the nature of the trouble.

CARBOLIC ACID POISONING.—A form of acute poisoning caused by the ingestion of carbolic acid, either accidentally or with suicidal intent. The first symptom is a severe burning of the mucous membranes of the mouth, gullet, and stomach, accompanied by excessive pain. This is soon followed by headache, nausea and vomiting, faintness and weakness, and death in consequence of a gradual paralysis of the heart. The urine is brownish, or greenish black. In such cases it is necessary to assist the activity of the heart by administering stimulants, such as strong, black coffee, Hoffmann's anodyne, etc. As antidote, water with the white of eggs, milk, a solution of Glauber's salt, or alcoholic drinks should be given. Attempts should be made at once to dilute the acid by copious draughts of water, which should be immediately washed out or vomited. A physician should be called promptly. Carbolic acid (*phenol*) leaves a tell-tale white scar on the mucous membranes, and this, together with the characteristic odour, is usually sufficient to make a diagnosis.

Continued action on the skin of unnecessarily strong solutions of carbolic acid, as occurs in frequent applications of carbolic acid compresses, may eventually lead to mortification of the skin and of the parts immediately beneath it. A solution containing only 2 per cent. of the acid may cause this. The skin turns first white, and then black ; and sometimes the fingers mortify after such carbolic acid bandages. Great care is necessary, therefore, in the application of the latter, especially when the solution of carbolic acid is not fresh. It is better to avoid them entirely, and, until the physician arrives, to use less harmful remedies which show equally good results ;

for instance, hot water, lead-water, or a 5 to 10 per cent. solution of boric acid.

A number of compounds widely used in the household and in medicine contain carbolic acid, and poisoning by them induces similar symptoms. Thus creosote, lysol, salol, resorcin, hydroquinone, and guaiacol should be included in this group.

CARBUNCLE.—A loose, general term which may mean one of several affections. A benign carbuncle arises from a neglected pimple or furuncle, or from several furuncles or small boils. Malignant carbuncles occur as a result of diabetes mellitus, or as infections from the micro-organisms of anthrax. The favourite sites of carbuncles are the neck and the region of the hip. The skin affected by a carbuncle becomes red, painful, thick, shining, and swollen. In the centre of the globular swelling, which may be from 2 to 3 or 4 inches wide, it becomes black and gangrenous ; that is, it begins to break down, and shows sieve-like perforations of the skin.

As the disease may lead to grave sickness, or even cause death, time should not be wasted with plaisters, cold-water compresses, etc., but a physician should at once be consulted. Cure is brought about only by making a large incision, causing relaxation of the inflamed tissue and facilitating the throwing off of gangrenous parts, which in turn are replaced by new tissue. See also FURUNCLE.

CARIES.—See BONE, INFLAMMATION OF.

CASCARA SAGRADA.—The bark of *Rhamnus Purshiana*, a tree which grows extensively in the western part of the United States, notably in Oregon and Washington. It is widely employed as a laxative and cathartic, owing these properties to a purgative resin which it contains. This resin is a complex body, largely composed of anthracenes. Cascara used internally is a mild bitter, stimulating the saliva and digestive functions. By reason of its irritant action on the intestine it causes increased peristalsis and catharsis. It is particularly valuable in chronic constipation, as it may be taken for a considerable length of time without impairing the motor functions of the intestine. It should not be confounded with proprietary remedies of a similar name. See CONSTIPATION.

CASTOR-OIL.—A fixed oil which is expressed from the seed of *Ricinus communis*, or the castor-oil plant, a native of the tropics, but extensively introduced throughout the world. The oil is a thick, clear, viscid, colourless and odourless substance. It is widely used in medicine as a cathartic. It owes its efficacy to a fatty acid (*ricinoleic acid*) which is produced by the action of the alkaline intestinal juices. This acid is an irritant, and causes a stimulation of peristalsis which results in catharsis. Castor-oil works very slowly, six to eight hours, and has the advantage of thoroughly emptying the bowel. Thus it is particularly useful in children or adults, in those disorders in which there is excessive fermentation and putrefaction of the

intestinal contents. It is used in doses of from half a teaspoonful to a tablespoonful, depending on the size and age of the patient. Very small doses of castor-oil are of service also in the treatment of chronic diarrhœa. The after-tendency to constipation following the use of castor-oil should be borne in mind. It has little food value when rubbed on the skin.

CASTRATION, FEMALE.—An operation consisting in the removal of the healthy ovaries. During the "seventies" of the nineteenth century it was frequently performed to treat certain nervous or mental disorders in which attacks of excitement or convulsions occurred, especially during the time of menstruation, which is an ovarian function. Owing to the uncertainty of the result, however, this operation has been abandoned except in extreme cases. It is now rarely resorted to even in cases of fibroid tumours of the wound; instead, the tumour itself is removed, as occasionally the "shrinking" of fibroid tumours fails to take place after castration. Castration is, however, sometimes considered in cases of absence of the womb, when the ovaries give rise to violent pains at the time of menstruation. See Ovaries, Diseases of; Ovariotomy.

CATALEPSY.—A condition occurring in nervous and in mentally deranged persons, and characterised by a peculiar straining of the muscles with the assumption of striking attitudes. There are two main forms of this disease, known respectively as catalepsy proper and katatonia.

In *catalepsy* the muscular rigidity appears generally without warning. The patient remains in the position in which he happens to be when the attack seizes him. This is accompanied by the remarkable symptom called *flexibilitas cerea* (wax-like flexibility), described below, and by decreased consciousness. The attack disappears after a time, but it may, under some circumstances, recur. Cataleptic rigidity of the limbs is most frequently observed in hysterical conditions, and also in certain mental derangements. In suggestible individuals it can be produced by hypnotism. The treatment varies with the cause. Stress should be laid on the fact that there is never any immediate danger to the patient, and therefore little cause for alarm.

Cataleptic states are found very frequently in patients suffering from a form of mental disease called *katatonia* (Dementia præcox). The position and movements of the patient become stiff and rigid, as though he were bound. The entire behaviour suggests a wooden and automatic image. At times patients will remain in certain positions for weeks, months, and even for years, lying in bed with the head bent, face contorted, the lips drawn together, the eyes closed, arms bent, and the legs outstretched or drawn up to the body. They neither eat nor speak, and they soil their bedding, and strongly resist any outside influence. Their muscles feel hard as iron, and their limbs cannot be moved without using great force; when left alone they relax into the old position. There are some patients who allow their limbs to be moved, and these let them remain like soft lead in any given position,

even an uncomfortable one, for a long time. Katatonic cataleptics may show a like uniformity in their behaviour and habits. They will perform repeated gyrations for hours, will fall down 40 to 50 times a day, and get up again, will trot around in a circle like a horse in a circus, will repeat incessantly the same foolish words or high-sounding phrases, will dance, trip about, giggle, etc. ; in short, they manifest a conspicuous, artificial, clownish behaviour. This condition is at times interrupted by sudden passing periods of excitation, accompanied by senseless howling and acts of violence. It is remarkable that memory and understanding remain fairly well preserved.

This disease occurs in both sexes, particularly about the time of puberty, and generally terminates in more or less mental debility, interrupted by occasional periods of apparent improvement. Such patients are best treated in a sanatorium.

CATARACT.—A term principally applied to grey cataract, a disease in which the pupil appears white or greyish instead of the normal black. It is caused by a loss of transparency of the crystalline lens, due to changes either in that structure or in its capsule. As a consequence the sight becomes impaired, sometimes advancing to the stage in which light can hardly be distinguished from darkness. The disease may occur in children and young persons ; but the most common form is the senile cataract which occurs after the fiftieth year. It begins with fine, ray-like radiations in the lens, and increases gradually until the entire lens is coloured grey. The development is usually slow, and may progress for years. Usually both eyes are affected.

There is no medical treatment for cataract. All advices of quacks are fraudulent. The only remedy is removal of the lens by operation. In ancient times and in the Middle Ages, the cataract was pierced with a needle, and the lens couched into the back part of the eye. As internal inflammation resulted, causing the eye to become totally useless, this method was dropped. At the present time operations for senile cataract are performed with great ease and skill, the translucent lens being removed from the eye by making an incision through the cornea. In patients with complicating diseases, notably diabetes, a successful outcome is not always assured. In children it is well not to delay the operation, in order that the operated eye may early become accustomed to seeing without the lens.

CATARRH.—a disease characterised by simple inflammation of a mucous membrane. Used without any specific qualification, the term is generally understood as referring to nasal catarrh. See CORYZA. For catarrhal affections of other organs, see under BLADDER, DISEASES OF ; BRONCHITIS ; CHOLERA INFANTUM ; EYE, DISEASES OF ; HAY-FEVER ; INFLUENZA ; INTESTINES, DISEASES OF ; KIDNEYS, DISEASES OF ; LARYNX, DISEASES OF ; PHARYNX, CATARRH OF ; STOMACH, DISEASES OF ; VAGINA, DISEASES OF ; WOMB, DISEASES OF.

CATHETERISM.—The procedure of emptying the bladder with the aid of certain instruments (catheters) especially made for this purpose. They are made either of metal (German silver, silver, or tin), or of varnished silk-weave, or of red, soft rubber. The catheter is employed either to empty the over-filled bladder (in retention of urine) or for purposes of diagnosis and treatment (washing the bladder). Catheterism, as well as the introduction of other instruments into the urethra, should be done only under certain conditions, on which the physician should decide. There is always a danger that bacteria may be introduced into the bladder with the instrument, causing an infection which may give rise to cystitis, or catarrh of the bladder. It should also be considered that a clumsy and forcible introduction of the catheter may injure the urethra, or cause abrasions of the mucous membrane of the bladder, which may lead to disagreeable consequences.

In general, a catheter should be passed only by a physician. If its application is left to the patient, as is sometimes necessary, the following general rules should be borne in mind. Only the soft rubber catheters should be used; hard instruments are in no way suitable for self-use. Before using the rubber catheter, which is made entirely from raw caoutchouc, it should be carefully examined with reference to its durability. Old catheters that have been in stock for some time become brittle, and it may happen that a fragment may break off, to remain in the urethra or in the bladder. The disinfection of these instruments before and after use is of the greatest importance. Before use they should be placed in a 1:1000 solution of silver nitrate or a 1:2000 solution of corrosive sublimate, and then greased with liquid paraffin. After use, the instrument should be cleansed with hot soap-water, and then rinsed and immersed in a 1:1000 solution of corrosive sublimate, after which it should be put into a jar that can be sealed.

Before introducing the catheter it is advisable to thoroughly cleanse the glans penis, the prepuce, and the opening of the urethra, by first washing these parts with soap and then rinsing them with a saturated solution of boric acid. It is of the utmost importance that the hands of the person who introduces the catheter should be thoroughly cleansed and disinfected. See Disinfection. Upon removal of the catheter, the outer opening of the instrument should be closed with a finger, or the end of the soft catheter compressed, in order to prevent the entrance of air into the urethra. If all these directions are borne in mind, self-catheterism, which is so necessary to many patients (for instance, in swelling of the prostate gland of the aged), may do little harm. Carelessness in following out these measures, which is so very apt to become prevalent in frequent practice of self-catheterism, is usually followed by death in from two to three years.

CELLULITIS.—A septic inflammation of the cellular tissues. The skin is connected with the underlying organs and tissue-strata by loose, cellular tissue. In consequence of its loose structure an inflammation may easily

develop and spread. The skin is exposed to innumerable injuries, and, as a result, these cellular inflammations below the skin are of frequent occurrence, especially on the fingers, where they give rise to so-called *felons*. The symptoms are heat, redness, and throbbing pain. The infected region swells, and also the neighbouring lymph-nodes become swollen and sore. Even lymph-nodes at a distance may become painful. In severe infections the chain of lymphatics leading to and from the site of infection may also show reddish and swollen. It is advisable, as a general thing, to have an incision made as early as possible, so that the pus will not invade the deeper tissues and cause a dangerous extension of the inflammation.

CEREALS.—The important cereals are wheat, rye, barley, oats, buckwheat, Indian corn, and rice. All these products are distinguished in that they most favourably combine the principal nutritive elements needed by man—namely, carbohydrates and proteids ; in that they are rich in nutritive salts ; and in that they are inexpensive, and therefore within the reach of everyone. As stated in the article on BREAD, those cells of the wheat-grain that are richest in proteids are arranged near the external covering of each individual grain, whereas the starch-cells (carbohydrate cells) occupy the centre of the grain. Grits, whole wheat, rolled oats, rice, and barley furnish very wholesome porridges and soups.

In spite of the high nutritive value of the different varieties of cereals, a diet based exclusively upon them is not advisable. The fact that in Asia many millions of human beings live on little but rice, while performing the severest kind of manual labour, cannot be considered determining for entirely different racial qualities and modes of living. Aside from the fact that only a part of the vegetable albumen of cereals is utilised in the body, whereas another, although smaller, part leaves it without having been used at all, an exclusive bread-diet is not without some danger to the organism. It may give rise to general affections of the bones, especially during the period of development, as well as to diseases of the stomach and intestine. These disadvantages become most manifest in individuals with mental occupations, whereas manual labourers, owing to their plentiful exercise and active metabolism, suffer less from these consequences. Bread, as well as porridges and soups made from cereals, are, however, of prime importance as popular foods. These foods have the faculty, in combination with fruit, vegetables, and small quantities of meat, of preserving the full working capacity without endangering health. In preparing cereals it is of importance to cook them well, as this will make them much easier of digestion.

CEREBELLUM.—See INTRODUCTORY CHAPTERS (p. 158).

CEREBROSPINAL MENINGITIS.—See MENINGITIS.

CHANCRE.—A preliminary eruption in two distinct diseases, and characterised as hard chancre and soft chancre. For hard chancre, see VENEREAL DISEASE ; for soft chancre, see CHANCROID.

CHANCROID (SOFT CHANCRE).—A wide-spread, infectious, sexual disease, to be distinguished from hard chancre, or syphilis. It is a comparatively mild affection, inasmuch as its duration is limited; permanent cure may always be expected, and a general infection is not associated with the essentially local disorder. In most cases of soft chancre, a spreading of the process takes place by way of the lymph-channels to the neighbouring lymph-glands, leading to the formation of painful buboes which often suppurate, and then again become chancrous. See Bubo. The infection is brought about almost exclusively by sexual intercourse, when an existing injury of the skin, or of the mucous membrane, or one ever so small occurring during the act, comes in contact with the secretion of a soft chancre existing in the other person. The cause of the affection is probably known (Ducrey's bacillus).

Soft chancre appears 24 to 48 hours after infection in the form of a minute postule or pimple, which soon broadens and breaks down, developing into an ulcer. This ulcer usually extends into the deeper layers of the infected site, with finely serrated and often undermined borders. The base of the ulcer is covered with a dirty, yellow membrane, which appears as if pierced by worms; the ulcer, which spreads rapidly, assuming the most various forms, is very painful to the touch. Proliferations occasionally form upon the ulcer, projecting like moulds over the surrounding tissue. In other cases the rapid spread of the ulcer is combined with gangrenous disintegration (*gangrenous chancre*); or a refractoriness in healing manifests itself even after the chancre has been present for only a brief time. Uncleanliness often causes a spreading of the poison, leading to the formation of several new ulcers in the immediate or more remote neighbourhood of the primary chancre. The favourite sites of the affection are the frænum and the lateral pouches of the internal leaf of the prepuce beside the frænum. Complete destruction of the latter sometimes leads to considerable hæmorrhage. After several (sometimes six to eight) weeks, the ulcer usually begins to become cleaner, ultimately healing completely, with the formation of a scar.

Any pustule appearing upon the genital organ a few days after a dubious sexual intercourse is suspicious, and requires examination and treatment by a physician. Until the latter has inspected the sore, it is advisable to keep quiet, observe scrupulous cleanliness, and apply antiseptic cotton and a cooling compress. Earliest possible treatment by a physician may essentially shorten the course of the affection; it may cause rapid recovery and may thereby prevent the disagreeable consequences of an inflammation of the lymph-glands. With the increasing knowledge among all classes of people of the importance of cleanliness, the forms of gangrenous chancre, which lead to considerable disturbances and destructions, have become very rare.

In order to prevent this affection it is essential to avoid exposure to

danger if there is present the slightest injury of the skin or of the mucous membranes of the genital organs. A small abrasion, a blister, or an inflammation, be it ever so small, of the glans of the penis, may serve as the portal of entrance for the poison. The only safe method to avoid this, as well as other venereal diseases, is to abstain from all illegal intercourse.

CHEESE.—An exceedingly important foodstuff, which combines cheapness with great nutritive value. Its bad reputation of being indigestible is largely due to the foolish habit of swallowing it without chewing it and breaking it into small pieces. Cheese may be called pure milk-extract. This is absolutely true of cream-cheese, which is obtained from unskimmed milk and which, therefore, contains the fat of the latter ; it is true to a lesser degree of skim-milk cheese, in the manufacture of which, partly or completely, skimmed milk is used. Milk contains an average of 89 per cent. of water ; and after the loss of this water and of some salts, cheese represents the actual nutritive constituents of milk. It must, therefore, be placed in the front rank of foodstuffs for the healthy as well as for the sick ; especially as cheese, if properly masticated, or grated in Italian style, and stirred into soups, does not make any increased demands upon the digestive organs. Soups which contain flour, and those prepared from grain products (groats, rice, farina, etc.) can be easily improved in taste as well as in nutritive value by the addition of grated cheese. Such food is especially to be recommended for children and weak individuals.

The epicure, it is true, demands different qualities of cheese ; he insists that it should be ripened by special bacteria, whereby digestion is relieved of part of its labour ; and he prefers cheese which has been rendered more palatable by moulds ; for instance, Roquefort, Stilton, and Gorgonzola, which are profusely streaked with the green swards of moulds, such as are found also on old bread. In addition to the green moulds there occur also red ones (likewise harmless) on the surface of certain kinds of cheese ; whereas the varieties of bacteria that ripen the cheese are much more numerous. As these are of importance to the taste, a more exact knowledge of them will some day contribute greatly to improve the manufacture of cheese. In some varieties of cheese (as Swiss cheese) the bacteria manifest their presence by the formation of holes, due to the decomposition of milk-sugar with the development of gas.

Hard cheese owes this quality in part to the abundance of phosphorated lime which it contains, and which is almost entirely absent in soft cheese. White cheese, or whey-cheese, differs from all others in that it is made from sour milk, whereas other kinds of cheese are made from milk which has been curdled by the addition of rennet. The following varieties of cheese may be mentioned : *Skim-milk* : Parmesan and Liptau ; *medium cream* : Edam, Emmenthal (Swiss), and Cheshire ; *cream* : Limburger, Roquefort, and Brie. The average composition of cheese is 25 to 30 per cent. of proteids,

8 to 10 per cent. of fat, and 3 to 5 per cent. of milk-sugar. Artificial cheese prepared from oleomargarine is not to be recommended.

CHENOPODIUM (WORMSEED).—The seed of the *Chenopodium anthelminticum*, a rank weed which grows about cities and towns. The seeds are about the size of a pin-head, of a light brown colour, and have a disagreeable odour and taste. The powdered seed is a very good remedy for roundworms in children. The oil of wormseed is also used. The child should fast for about twelve hours before taking the drug, which should be followed by a purge.

CHEST, DROPSY OF.—A disorder caused by an exudation of blood-serum into the pleural cavity. In contrast to pleurisy with effusion, there is no inflammatory process present in the pleura in this condition. This process is merely a part of a generalised dropsy, and is an accompanying symptom of some severe disorder, as diseases of the heart or of the lungs, cancer, chronic Bright's disease, leucocythemia, dysentery, or of cachexia due to syphilis or to malaria. The recognition of the disease demands a very careful medical examination, in order to exclude a wet pleurisy on the one hand, and to discover the underlying disease on the other.

The essential effects of a collection of fluid in the pleural cavity are to cause marked pressure on the lungs and to displace the heart. Pressure on the lungs makes respiration more difficult, and a dyspnœic condition may be brought about. The skin assumes a bluish tinge on account of the abnormal quantity of carbonic acid in the blood, and the pulse becomes small and rapid. Treatment must be directed to the underlying disease, so that no general indications can here be formulated. The accumulation of the fluid itself is only made a subject for attack in case its volume is so great as to lead to a possible danger from asphyxiation. When this is the case, aspiration of the contained fluid is indicated, which, if skilfully executed by a practised hand, is an almost harmless procedure.

CHEST, PAINS IN.—The lung has so little sensitiveness that even extensive destruction of its tissue may take place without producing the least amount of pain. The distressing symptoms to which this name is given come from the pleura, the thoracic muscles, the ribs, or from the intercostal nerves.

Pain as the result of irritation or inflammation of the pleura is very frequent, and in the early stages of a pleurisy it constitutes the most significant and distressing symptom. If, after the inflammatory process has subsided, adhesions are left between the pleura covering the lungs and that covering the ribs, sensations are produced which are annoying and even painful. This is due to the tearing action to which the bands are subjected by movements necessitated by the respiratory act.

The pain which results from any affection of the ribs is increased by pressure over the diseased area. This is also true in fracture of the ribs,

and here the condition may furthermore be recognised by the crepitation which is produced when the broken ends of the bones are rubbed together by the fingers of the examiner. Contusion of the soft parts of the chest, caused by a fall or a blow, is also accompanied by pain. In other cases, pain in the intercostal muscles may be due to rheumatism or to a neuralgia of the intercostal nerves. The latter affection is seen more often in women than in men, and the pain is localised along one or more of the intercostal spaces corresponding to the affected nerves, or it may be more severe at certain points than at others.

The treatment of pain in the chest must be merely local, but must be governed entirely by the cause as determined by a most careful examination. In all cases rest (preferably in bed) must be insisted upon, because motion and deep respirations always aggravate the pain. If medical assistance cannot be had at once, hot applications to the back and chest will afford a great deal of relief. A faulty position of the body will undoubtedly bring on pain in the chest, and this is a fact which is not fully appreciated. Persons who follow sedentary occupations should be cautioned to sit straight; and at frequent intervals, if only for a few minutes at a time, they ought to get up and, with arms outstretched, take a few deep, long breaths.

CHICKEN-POX.—A contagious, febrile disease of children, characterised by eruptions of scattered vesicles. It attacks most children, leaving them immune against the contagion afterward. The disease-symptoms appear 13 to 17 days after infection. The patients feel sick, have moderate fever, headache, some dread of light, and loss of appetite. During the course of the two to three days of fever, a rash appears, especially over the trunk and head, also in the face, less frequently on the limbs. At first this rash is punctiform, and develops rapidly into papulæ and vesicles. The vesicles are isolated, and are surrounded by a reddened zone; they dry quickly, and generally scab over without leaving a permanent visible scar. The rash itches considerably, and is frequently scratched, which at times causes it to become ulcerated. In such cases it heals as a scar. In children with unhealthy skin, the eruption may assume a serious ulcerative character.

Parents are advised to keep the children in bed, at least until the rash has dried, but not to keep them too warm. The sick-room must be ventilated frequently. The itching sensation is considerably eased by washing with lukewarm water and powdering with antiseptic powders. In appearance, chicken-pox resemble the mild forms of smallpox, which, however, is a totally different disease; recovery from chicken-pox does not make the patient immune from smallpox, and vice versa. It is highly important always to consult a physician, as many cases of smallpox have been taken for chicken-pox and serious epidemics arisen. Although chicken-pox is a very mild affection, it is an unnecessary one. Patients should be isolated, and great care exercised to prevent the spread of the infection.

CHILBLAINS.—Flat or nodular swellings and elevations, which at the onset itch greatly, and are often very painful. They are due to paralyses and dilatations of the blood-vessels, resulting from a disturbance of the circulation of blood in the skin under the influence of low temperatures. Chilblains develop especially on projecting parts of the body, such as the nose, ears, fingers, toes, and knuckles. They cause the affected parts to lose their pliability; the heavy, irregular bruises become bluish, red, smooth, and glistening (as if varnished), and sometimes the formation of moist vesicles is noted. A continued disturbance of circulation gives rise to sores, fissures, and crusts, from which ulcers may develop. It is a mistake to believe that chilblains can appear only when the temperature is below the freezing-point, as they may arise also without frost; for instance, as a result of frequent washing in cold water. Deficient circulation of the blood favours their formation in such instances.

To prevent chilblains it is necessary to keep as warm as possible. Anyone with a tendency to cold hands and toes must not fail, in winter, to encourage the circulation of the blood by frequently bathing hands and feet in hot and in cold water alternatingly. This will tend to strengthen the muscles of the blood-vessel walls, the relaxation and numbness of which cause chilblains. Anyone suffering from cold feet should wear wide, comfortable shoes, and in winter thick, woollen stockings which extend above the knees (so-called hunting-stockings). Experience teaches that such stockings furnish the best protection. Pulse-warmers (wristlets) and mittens are better than the usual gloves, as the latter do not prevent the occurrence of chilblains. Persons prone to this affection in certain parts of the body should rub these parts several times a day with a piece of pure camphor, such as may be obtained in any drug-store. After chilblains have developed, a 10 per cent. camphorated collodion should be painted on the affected parts with a brush. Remember that collodion is very inflammable.

CHILD, CARE OF THE.—See Health-Care of Children.

CHILDBED.—In a limited sense childbed embraces the time needed for the healing of the wounds of the internal generative organs, caused by childbirth; in a broader sense it embraces the time needed for the complete involution of the pelvic and abdominal organs, which generally takes six weeks. After this space of time the first menstrual period begins, unless delayed by nursing, which happens in the large majority of cases.

As in the case of other wounds, not neglected nor infected, the wounds caused by childbirth heal without fever or material pains. After childbirth the woman is exhausted from the exertion attendant thereon, and needs rest; and this being necessary for quite a long time, it is important to lay her in a clean and comfortable manner. The duration of childbed of a healthy woman may last in some cases only a few days, while in others it may take from three to four weeks. The former is too short a period for

most women, and the latter too long, causing relaxation; nine to twelve days is the best average time. At the beginning, the woman should lie on her back; later, on her side. The mattress must be protected by a rubber sheet, four feet square, covered by a sheet in which to take up the discharges; over this another folded linen-cloth should be drawn across the bed, under the sacrum. The bedding must be absolutely clean and dry. The lochial discharge is caught in gauze napkins, and should not smell badly. If it is offensive, it contains foul germs which ought not to occur. During the first few days the discharge from the interior of the womb is bloody; then it becomes watery, until the end of the first week, and then white. If it is bloody for a longer time, it is a sign of faulty contraction of the womb. Severe hæmorrhages are caused by remnants of placenta or by inflammations. Furthermore, there may be abnormal discolorations (like burnt raspberry-jelly); or, in very severe cases, a sudden cessation of the lochia, without changes in the odour, may occur.

The excreta of a confined woman should be taken up in bedpans (Fig. 101), as she should not leave the bed. The urine should be passed twice daily from the very beginning, as the bladder is paralysed at times and may become distended by retention of urine. Women in childbed, who cannot urinate when lying on the back may be assisted to sit up in bed, but this should be done slowly and carefully. There is another advantage in the sitting posture in that the lochial discharge can flow more readily from the vagina. It is wise to make attempts to urinate while lying on the back before the time of childbirth. Laying the hand over the bladder is at times helpful for the patient who cannot urinate. The paralysis of the bladder may often be overcome by the application of hot towels, by spraying the opening of the urethra, or by the use of an enema. If these means are not successful, the practised hand of the nurse or physician must insert a catheter, after disinfection of the mouth of the urethra. The catheter should be boiled before use.

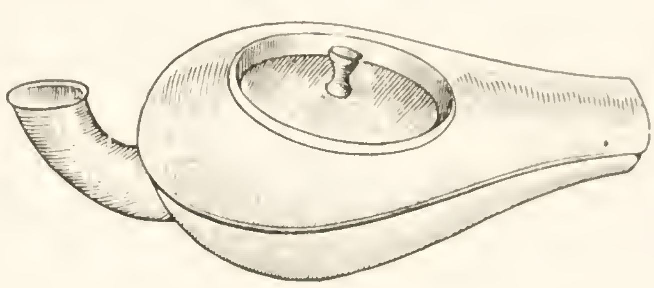


Fig. 101. Bedpan.

On the third or fourth day after confinement there should be a movement of the bowels, and this may be furthered every third day by administering a dessertspoonful of castor-oil, or by enemas. To overcome the intestinal inertia, the patient should take cooked fruit, fresh vegetables, a predominantly liquid diet, brown bread, honey, and butter. The enemas must measure about a quart (not much more), to which may be added a teaspoonful of cooking-salt, five tablespoonfuls of salad-oil, or a piece of glycerine-soap the size of a walnut. If there is flatulence, peppermint and fennel tea may be given in addition to the enemas. After each evacuation of the bladder and of the intestine, the external genitals must be washed

clean and sprayed. Sponges must not be used for this purpose, as they are never free from disease-germs ; but absorbent cotton or sterile gauze should be used in their place. For disinfecting the genital organs, creosol (half teaspoonful stirred well into two quarts of boiled water) or lysol (one part to 100 of water) may be used. These directions also hold good in cases of miscarriage or of premature birth, and the various necessaries should, therefore, be in readiness before the time of expected confinement ; the infant's clothes need not be ready before the eighth month. Clean water is not necessarily free from germs, and therefore must not be used for washing the genitals before it has been boiled. The addition of a disinfectant is not as effectual as boiling. The sacral region must be kept very clean, and if necessary it must be treated with vinegar-water or with a desiccating powder, so that the patient will not get sore. If this condition does occur, zinc-salve should be applied to the part, and an air-cushion placed under the patient. Generally, bodily cleansing is necessary once or twice daily, and is effected by a lukewarm bath of the entire body, including the back and the sacrum. The additional treatment of the skin for the restoration of elasticity may be effected by abdominal massage, which must be given only by a practised hand, and only in cases which are free from fever. The massage-treatment also tends to stimulate the circulation of the blood in the mammary glands, and to encourage the flow of milk.

For the prevention of pendulous abdomen, the abdomen is laced. The relaxation of the abdominal walls causes the intestines to become inflated, and the blood and lymph-vessels in the suspensory ligaments of the organs to become abnormally distended with fluid, which causes them to relax. When the patient gets up all the organs sink, giving rise to floating kidney, gastroptosis (falling of the stomach), and flatulence, as well as to retroflexion, prolapse, and catarrh of the womb. After evacuation of the bladder and intestine, and after the abdominal massage, two towels should be placed under the patient below the sacral region, then drawn firmly over the abdomen and hips, and securely fastened together with several safety-pins. The abdomen may be compressed also by means of several sheets or by a sand-bag ; this, however, should not be done until it has been laced, since, otherwise, it will merely flatten the abdomen. Later on, gymnastic exercises for the abdominal muscles may be resorted to as effective remedies for the prevention of pendulous abdomen.

The diet to be observed during confinement must necessarily be strict and simple. This is of importance not only in regard to the return to their normal condition of the abdominal walls and organs, but also for certain other reasons. Our ancestors knew this well enough, even if they did not understand the reasons for, or the limits of, a restricted diet. They recommended an exclusive liquid diet consisting of milk and paps. Such a diet prevented digestive disturbances, promoted the secretion of milk, and

assisted perspiration. There was great need of such a procedure in former pre-antiseptic times, on account of the frequent occurrence of puerperal fever. It is imperative to avoid digestive disturbances ; not because they may be the cause of puerperal fever, but because such disturbances readily occur during confinement, and interfere with the proper involution of the pelvi-abdominal viscera and with the secretion of milk. Taking into consideration the fact that the diet should be easily digestible, and remembering its effect on the secretion of milk, the following dietary is advisable in cases of confinement : During the first three days liquid food only should be given, particularly milk, sweetened water, cocoa without spices, and eggs ; a small quantity of zwieback or dry toast may be added. From the fourth to the sixth day (if the bowels have moved) the diet may include also some white meat, the sweetbread or brains of calves, squabs, white bread, and stewed fruits. After the seventh day beef (roasted, broiled, or smoked), ham, vegetables easy of digestion, and light puddings may be eaten. Spices, alcoholic drinks, food insufficiently cooked, fat meat or pork, unripe fruits, salads, and bread or pastry not readily digestible should be entirely avoided.

An inclination of the womb to retroflexion, dropping, and prolapse, which frequently accompanies a tendency to pendulous abdomen, is also best overcome during confinement. For women who are thus afflicted, a lateral position is best ; but above all else they must be scrupulous about emptying the bladder at regular intervals. Apart from the healing of the womb, it is necessary that all tears in the perineum should be immediately repaired, for experience teaches that otherwise there will be insufficient support for the generative organs, thus contributing to the causes of sinking and prolapse of the womb. The sewed wound must be carefully treated and kept clean ; otherwise it will not heal.

The patient's room should contain only such furniture as is necessary, and everything which tends to collect dust should be taken out. The room should not be kept dark, and must at all times be well ventilated ; heavy draperies are, therefore, superfluous, or even harmful. Usually, the patient is confined in her own bedroom. For the sake of good health in general, a bedroom must never have damp walls, and to avoid this is especially important in cases of confinement ; in the winter the room should have proper heating facilities. No bed which has previously been occupied by a patient suffering from an infectious disease should ever be used in a case of confinement, unless everything connected with it has been thoroughly disinfected by professional disinfectors. The mattress, especially, should be dry and clean. The sheets, pillows, and covers must be clean and perfectly dry, and this applies also to the linen worn by the patient. The bedpan, chamber-pot, syringe, etc., must be in faultless condition ; the syringe should be provided with four to five feet of rubber tubing and two glass tubes. Near the expected time of confinement, it is advisable to give the room a thorough

cleaning in all corners, and to hang new curtains. The floors should be scraped and washed with chloride of lime. A large supply of body-linen, bed-linen, and towels should be kept in an accessible and dry place; and the nurse or midwife should be shown in good time the arrangement of the room and the wardrobes.

In addition to general bodily hygiene, mental rest is essential to the patient during pregnancy and childbirth, as well as during confinement and throughout the entire period of nursing. Sudden excitement may cause severe hæmorrhages and permanent relaxation of the pelvic organs, in consequence of disturbances in the circulation of the blood. The same applies to bodily and mental exertions. The proper time for the patient to get up depends upon her pulse and temperature, as well as upon the character of the lochial discharge (whether bloody or otherwise), and upon her general condition. In all cases the family-physician should decide, as in this way threatening accidents (as thrombosis, etc.) may be guarded against. It is not as burdensome for the patient to take mild exercise as it is to assume the full control of the household; and at least two weeks should elapse before taking up these duties. Women who cannot get the necessary care and attention in their homes ought to go to a lying-in hospital.

CHILDBIRTH.—See PARTURITION.

CHILDLESSNESS.—See STERILITY.

CHILDREN, CARE OF.—See HEALTH-CARE OF CHILDREN.

CHILLS.—See MALARIA.

CHLORAL.—A compound drug which occurs in whitish or colourless transparent masses or in little crystals. It is volatile, quite soluble, and has a burning taste. It should be kept in a dark place, tightly corked. It is one of the commonest hypnotics, or sleep-producers. Locally, it acts as a powerful irritant. When taken internally it depresses all the functions of the body, acting perhaps most powerfully on the nervous system, but also depressing the heart and breathing-apparatus. In moderate doses the only effect usually seen is what appears to be a deep, normal sleep from which the patient can be aroused. After a poisonous dose the sleep is deeper, and may pass into profound unconsciousness. The pupil of the eye becomes dilated; the breathing is shallow and slow; the pulse is rapid and irregular, or may disappear altogether; the body is absolutely relaxed; and the skin is pale and clammy. In case of an over-dose, a doctor should be summoned at once. While waiting for his arrival, the patient should be made to vomit, if possible, by administering large draughts of warm salt water or a couple of tablespoonfuls of mustard in a glass of water. He should be wrapped up warmly in bed with the feet higher than the head, and kept awake if possible. The habitual taking of the drug may cause mental and physical weakness, palpitation of the heart, shortness of breath, or skin eruptions. Chloral is used for any form of sleeplessness not due

to pain, but it is not as safe a drug as several others which are used for the same purpose. It is used in combating convulsions, such as in strychnine-poisoning, or in tetanus. In these conditions it is often necessary to give it by rectum.

CHLORATE OF POTASH.—A drug which occurs in small whitish plates, having a pearly lustre. It is a local irritant, and taken internally in large doses it may cause severe symptoms of poisoning, and even death. Pain in the head and abdomen, weakness, shortness of breath, and weak, running pulse may occur. The stomach should be emptied immediately. Combined with other drugs, chlorate of potash is useful as a mouth-wash in various forms of inflammation of the mouth. It is used also as a gargle, and is given internally for sore throat. As a mouth-wash or gargle it is used in a strength of about ten grains to the ounce. The dose internally is one or two grains.

CHLOROFORM.—A clear, colourless liquid, with a peculiar sweetish odour and a burning taste. It was introduced as an anæsthetic in 1847 by Sir James Young Simpson, a physician of Edinburgh, a few years after ether had first been used for this purpose. By making it possible to perform surgical operations without pain to the patient, these drugs broadened the scope of surgery almost infinitely, and have proved a priceless gift in prolonging life and lightening the burden of suffering humanity. In these days it is almost impossible to realise the tortures that had to be endured before the advent of anæsthesia. Chloroform is administered as an anæsthetic by inhalation. There are various devices by which this is accomplished, all based on the principle of allowing the vapour of a little chloroform, mixed with a plentiful supply of air, to be inhaled. It is usually dropped on a gauze or cloth mask held over the patient's nose and mouth. When taken in this way there are three indefinite stages of anæsthesia noticed.

During the first stage there may be at first a sense of suffocation. The face and head begin to feel warm, there is a buzzing or ringing in the ears, and everything seems far away. Sensation is blunted; and this stage is sometimes utilised to perform slight operations, or to ease the pains of childbirth. This condition soon passes into the second stage, that of excitement, which is not unlike alcoholic intoxication. The patient may laugh, sing, pray, or swear; and he moves more or less, sometimes struggling violently. At this stage the patient is usually entirely unconscious of what is going on about him, and is insensible to pain. The third stage is one of complete unconsciousness and muscular relaxation. It is at this time that the surgeon operates. By careful observation of certain signs, with occasional administration of a few drops of chloroform, the patient may be kept for hours in a condition favourable for operation, and yet not too deeply under the influence of the drug. Upon the withdrawal of the drug the patient may pass through a second period of excitement resembling the

previous one, but usually less violent. He may be nauseated and vomit, whereupon he may go into a peaceful sleep lasting for hours. Chloroform is a depressant to the heart, and notwithstanding every precaution a fatal accident will occasionally occur—about once in four thousand cases. For this reason most surgeons prefer to use ether, which is considered somewhat safer under ordinary circumstances, there being (according to Wood) about four times as many deaths from chloroform as from ether. Chloroform is less irritating to the kidneys and lungs, and is generally chosen in conditions affecting these organs. It is sometimes used to control violent convulsions. Internally it is given for intestinal colic, ten or fifteen drops of the emulsion or spirits being used. Chloroform liniment is a familiar remedy for external use in painful muscular affections.

CHOCOLATE.—A Mexican word originally signifying the beverage prepared from cacao, but now usually designating a combination of sugar, spices (vanilla), and the cacao-mass. This preparation is generally placed on the market in tablet form, and contains varying proportions of sugar and cacao. When large quantities of sugar are present, as in the cheaper grades of chocolate, it becomes necessary to add an increased quantity of cacao-butter in order to preserve the proper consistency of the mass. For these reasons the inferior grades of chocolate are sweeter than the better qualities, and contain more fat, unless they have been further adulterated by the addition of starch. Chocolate must be regarded as a valuable food, saving, especially hunters and travellers, the inconvenience of carrying bulkier food of different grades ; it also possesses the advantage over ordinary foods of being a stimulant for the fatigued, owing to its contents of *theobromine*. See Cacao. But the nutritive value of chocolate for domestic use should not be overrated, since it is greatly limited by the small quantities used, as well as by the inferior quality of chocolate often unwittingly purchased. It is advisable, therefore, to use milk in the preparation of chocolate for invalids and children ; and if it is desired to still further increase the nutritive value an egg may be added.

CHOLERA ASIATICA.—An acute infectious disease, characterised by pain, excessive diarrhœa, rice-water discharges, and intense collapse. The disease is endemic in certain portions of India, where it rages most of the time, occasionally spreading to other parts of the globe. In the United States epidemics of cholera occurred at irregular intervals from 1832 to 1873. Since the beginning of the nineteenth century, when the disease became more completely recognised, Europe has had six cholera epidemics ; and local infections, transplanted through shipping, are of frequent occurrence. It is a subject of popular belief that a very hot summer, in which many people are suffering from diarrhœal troubles, has a tendency to bring with it an epidemic of cholera. This is, however, an error, as cholera neither develops of itself nor is due to other diseases or climatic influences.

It can develop only when the infectious materials are transported from India and spread about in other localities.

The germ which causes the disease is a microscopic organism belonging to the low group of plants known as bacteria. It was discovered by Robert Koch, and is called the comma-bacillus or *Spirillum choleræ-asiaticæ*. Cholera can be caused only by these germs gaining entrance into the intestinal canal; either with the food or drink, or in any other accidental way. The germs multiply very fast, and produce toxic substances which are absorbed from the gut and give rise to disease-processes in various parts of the body. The cholera bacilli are thrown off from the body with the evacuations from the bowels; and the patient's stools and everything else which either directly or indirectly comes in contact with him are therefore means of spreading the contagion. Dryness kills these germs very quickly, however, and they remain infectious only while lodged in or upon objects which furnish a sufficient supply of moisture. In addition to the patient himself, his clothing, wash, excrements, etc., it is well also to regard water, milk, fruit, and other foodstuffs as possible carriers of infection.

The more careful and thorough the study has been of the manner in which the disease has been distributed from its Indian home, the more evident it has become that this transmission has followed the lines of travel and transportation. The contagion is carried from place to place by infected persons, and not by the wind or similar agencies. In order to protect a country against the invasion, it is necessary to direct the attention to individuals coming from an infected port. Formerly all intercourse was interrupted with localities in which cholera was raging, and travellers were isolated and kept under observation for several weeks before being admitted to free intercourse with others. As a matter of fact, however, it was found that even these stringent rules accomplished very little. Ways and means were usually found to escape the quarantine regulations if an individual was very desirous of doing so; and the disadvantages and losses resulting from the restrictions placed on trade and intercourse were enormous. In later years the protracted quarantine of travellers has been somewhat modified. Persons coming from infected ports are now allowed to land, but their health is carefully watched, and especial care is taken that every suspicious case is at once reported to the proper authorities for further observation.

It must not be forgotten than an individual may swallow a certain number of cholera bacilli without becoming afflicted with a severe attack of the disease. Many persons thus infected suffer only a slight diarrhœal trouble, and others even less in the way of symptoms; yet their stools may serve as a source of infection to numerous other more susceptible people. During the prevalence of a cholera epidemic, all cases of diarrhœa must be viewed and treated with suspicion.

The more important precautions to be observed during an epidemic are the following: In the first place one must beware of having too great a fear of becoming infected. It is an axiom of long experience that fear, as well as all other agitated states of the mind, increases the susceptibility of the body to the invasion of disease. Even if cholera breaks out in the locality where one lives, it is better to remain than to go away, because at home one is best able to continue without interruption the usual mode of life and also to avoid digestive disturbances, which greatly increase the liability to infection. An attack of diarrhœa, however slight, necessitates immediate recourse to medical advice.

Articles of diet on which the germs of cholera are usually found, such as fresh fruit, vegetables, and milk, should always be thoroughly boiled before being eaten, unless their source is free from suspicion. Water which has been contaminated by contact with the excreta from cholera patients is often the source of infection. For all household purposes, only such water should be used which comes from sources of supply known to be uncontaminated, and if there is any doubt, the best thing to do is to boil it before use. During the prevalence of cholera it is best to avoid houses in which the disease is known to be present, and also all public meetings and places of amusement where many people congregate. Neither is it wise to lodge persons in one's house who have come from infected localities; and all articles which have been used by patients must not again be employed unless thoroughly disinfected. Public baths and toilets should be avoided. Absolutely no value attaches to the numerous proprietary prophylactic remedies which regularly appear during a cholera epidemic. They benefit no one but their manufacturers and sellers.

If, in spite of all these precautions, a member of the family is attacked by the disease, it is advisable to send the patient to a hospital. Aside from the experienced care and attention which is enjoyed, there is the additional advantage that all the infected clothing and the excreta can be properly disinfected, and that in this manner further contagion can be to a great extent avoided. If the patient remains in the house, it is necessary to isolate him completely, together with his nurse. Extreme cleanliness is one of the most essential things. The stools and soiled articles must be disinfected in the way prescribed by the physician. During the period of the disease nothing must be removed from the sick-chamber. The nurse must not be permitted to take any food or drink while in the patient's room, and she must wash her hands thoroughly every time she has touched the sick person. In case of death, the body should be removed from the house as soon as possible, placed in the casket without being washed, and buried with little or no public ceremony. After either recovery or death, the room should be thoroughly disinfected as described in the article on DISINFECTION.

It is necessary for the public authorities to consider every inmate of the

Fig 1

Fig 2

PLATE VI.

Fig. 1. Left ventricle (opened). Wall thickened by disease, and cavity dilated.

1. Aorta (opened) 2. Semilunar valves

3. Mitral or bicuspid valve

Fig. 2. Thrombus (coagulated blood) in vein.

Plate VI.

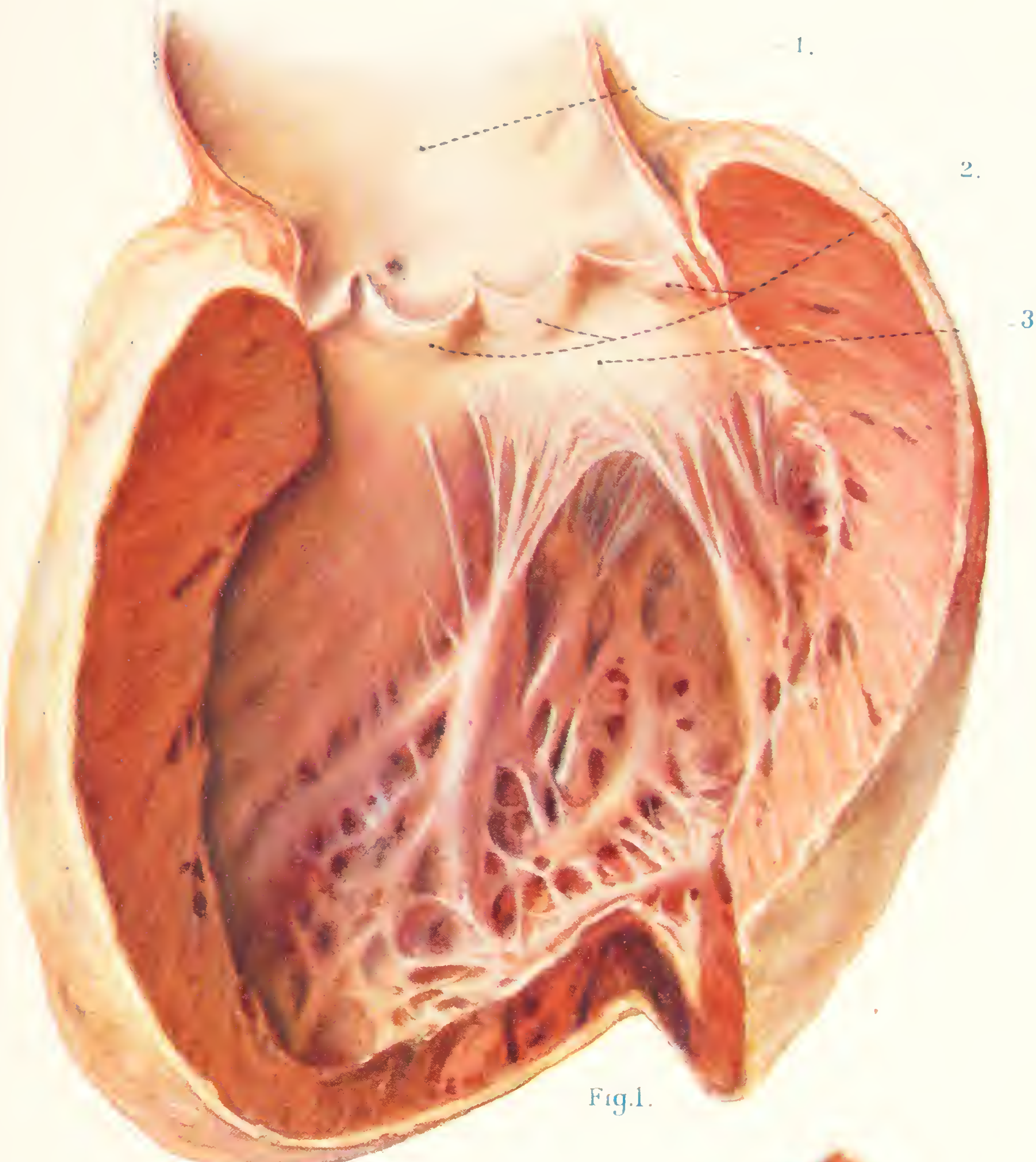


Fig.1.


Fig.2.

house in which a case of cholera exists as capable of carrying infection ; and it is therefore necessary that they be subjected to certain rules and regulations.

Cholera in its severer forms begins in from twelve hours to five days after the reception of the contagion in the intestinal tract. The first symptom may be an apparently harmless diarrhœa, gradually succeeded by all the other symptoms ; or the disease may be marked from the very beginning by severe vomiting and diarrhœa. The evacuations become very numerous and resemble rice-water or pea-soup. In a few hours the patient may become rapidly exhausted from the resulting weakness. The skin is dry and cold, and when pinched into a fold it remains thus ; the face displays an expression of suffering ; the voice is dull ; a burning thirst is felt ; the quantity of urine steadily diminishes ; and painful cramps in the muscles, especially in the calf of the leg, torture the patient greatly. The weakness increases, and death ensues. Even when the symptoms improve and the patient appears to revive, a favourable prognosis is by no means certain. He often succumbs after days or weeks from the consequences of the attack. As has already been stated, not all cases of cholera run such a virulent course, and many much milder ones occur. Many of the very severe ones also end in recovery.

There are no specific remedies or methods of treatment with which recovery may be assured in the severe cases of cholera. Nevertheless, timely and appropriate medical care will do much to diminish the sufferings entailed by the disease, and also to sustain the strength of the patient.

CHOLERA INFANTUM.—The so-called summer-diarrhœa, an affliction which carries away many children in their first year of life. It prevails at any time from May to October, but most frequently during July and August. Excessive heat and high humidity are factors favouring its development. Artificially nourished infants are particularly prone to the disease, which is unquestionably dependent on changes which the heat produces in the milk. Among the immediate causes may be mentioned the presence of pathogenic bacteria in milk which is not handled in a cleanly manner, ferments which are present in the fodder fed to the cows, overfeeding with milk which contains too much albumin, and too early feeding with gruels. In many cases with complicating dysentery, a specific bacterial flora is present, the *Bacillus shiga* being one of the most common representatives.

The children may be very restless before any definite symptoms of the disease appear. They cry pitifully, and constantly draw up their legs over the abdomen, which is distended and tender to the touch. After a time the stools become green, or consist of mucus streaked with green. In other cases the initial symptoms may be eructations and vomiting. The stools then increase in frequency, and are thin, green, like rice-water, or mixed with mucus. If not already present, vomiting follows. If nothing is done

for these children, they become rapidly weaker from this continued diarrhœa; the cry becomes hoarse and moaning, the eyes sink in, the nose becomes pointed, the fingers cold and blue, the skin dry, and a series of convulsions may bring about a fatal ending. If these symptoms appear in a child previously well and having normal stools, no time should be lost in summoning a physician. In the meanwhile all nourishment must be stopped, and the intense thirst may be satisfied with a little boiled water or weak tea. If an irrigator is at hand it is well to give the child several enemas of lukewarm water. In every case, the soiled napkins should be saved for the physician's inspection, so that he may note the character of the stools.

CHOLERA MORBUS.—An acute affection of adults or adolescents, resulting from indiscretion in diet. It may be due to the quantity, but is more often due to the quality and kind of the food. The numerous component dishes of a single meal are often, when mixed together in the stomach, the means of generating a disturbance. In the summer there is more apt to be trouble from the ingested food than in the winter, because many articles of diet are somewhat decomposed as the result of the heat, and contain toxic substances. Then, again, the body is frequently subjected to a sudden cooling by iced drinks. Sudden variations of outside temperature is an important factor in some people. Among the great variety of dishes which may produce these gastro-intestinal disturbances may be mentioned fatty food, sausage, cheese, salmon, lobster, mushrooms, pickles, sour milk, and unripe fruit. Sometimes the first symptoms of the trouble may be noticed immediately after the meal, sometimes not for a few hours or not until night. They consist of severe gastric and abdominal pains, fever, sometimes chills, vomiting (first of blood; later of mucus, water, and bile), and of diarrhœa which often persists until the stools become watery. The patient finally becomes weak and exhausted. The cause of these disturbances is a slight inflammation of the stomach and intestines, which may last several days, and then entirely disappear. If the condition is neglected, however, the catarrh becomes chronic, and results in many cases in more or less continual digestive disturbances. One of the noteworthy accompaniments of the trouble is extreme thirst, which is due to the marked loss of water from the body in the vomitus and stools. The appetite for solid food, on the other hand, seems to be entirely lost. The urine is also scanty in amount. A loss of several pounds in weight may result in a few days as a consequence of one of these attacks.

The elements of treatment are very simple: rest in bed, and the continued application of heat to the abdomen. The heat should preferably be dry, and may best be applied in the form of hot plates, sand-bags, or hot-water bottles. The diet should be fluid and cold, and given in small quantities. The most suitable articles are iced milk and chocolate, tea, cracked ice to overcome the nausea, and cold gruels. It may benefit an adult

patient to abstain entirely from food for twelve hours. It is advisable to administer a brisk cathartic at the very first signs of trouble, in order that the decomposing food which predisposes to the catarrhal conditions may be thoroughly evacuated from the intestinal tract. Castor-oil is usually effective. As soon as free evacuations have been secured, the physician may administer medicines to again quiet the digestive canal. A moderate and carefully chosen diet should then be adhered to for a few days more.

CHOREA.—See St. Vitus's Dance.

CHOROIDITIS.—See Eye, Diseases of.

CIMICIFUGA.—The root of the black snakeroot, or *Cimicifuga racemosa*, a plant about six or seven feet in height, growing in damp, shady places. It is used most commonly for St. Vitus's dance in children, acting very satisfactorily; especially when given with some preparation of iron and laxatives. Brain-ache is a sign to discontinue its use. Too large doses cause dizziness, with severe headache and general prostration.

CINCHONA.—The bark of a number of trees growing naturally in the northern and western parts of South America. Several varieties of these trees are utilised, and are extensively cultivated in various parts of India, especially in the Himalaya Mountains and in Ceylon and Java. There are numerous preparations of cinchona used in medicine, all having the same action because of the presence of the active alkaloid *quinine*.

Quinine sulphate, in which form the drug is generally used, is a white crystalline powder, having a very bitter taste. Its most important use is in the treatment of malaria, in which disease it has a direct curative effect. This is due to the fact that quinine, even in very dilute solutions, is poisonous to the germs which cause the disease by invading the patient's blood-cells. It is best to precede the administration of quinine by a dose of calomel, and then, starting four hours before the expected chill, to give five grains of quinine every hour for four hours, so that a large amount has been taken before the chill would naturally occur. If the dose is large enough, there is no chill. This treatment is continued long enough to eradicate the germs from the blood, other drugs being required in the convalescent stages. In severe cases it is sometimes necessary to administer quinine by injections under the skin or by rectum. To prevent infection in a malarial district, about six grains a day should be taken. Quinine is used also to reduce fever in other conditions, but it is not as satisfactory as some other measures. In combination with other drugs it is often given as a tonic. A large dose of quinine will cause ringing in the ears and some deafness. Certain people are very susceptible to its influence, and notice this disturbance after a small dose. People who live in malarial countries, and who are accustomed to take the drug, sometimes take enormous doses without any unpleasant effect. Very large doses are said to have caused temporary blindness or deafness, and various eruptions on the skin.

CINNAMON.—The inner bark of several species of *Cinnamomum*, plants growing in China and in Ceylon. The bark contains tannic acid and a volatile oil which gives it its peculiar aromatic odour and taste. Its principal use in medicine is to disguise the taste of less agreeable remedies. Cinnamon has a stimulating effect on the stomach and intestine, and is sometimes used in watery diarrhœas or in relieving distention. It is occasionally of service in controlling bleeding from the womb. The form in which the drug is usually given is as the water of cinnamon, the dose being a wineglassful or less, or as oil of cinnamon in drop doses. Large doses are poisonous, largely because of the presence of a high percentage of a phenol (*eugenol*) in the volatile oil.

CIRCULATION.—See Introductory Chapters (pp. 156–157).

CIRCUMCISION.—Term applied to the operation for partial removal of the foreskin of the penis. Among the Jews this forms part of a religious ceremony. Under ordinary circumstances the operation is done when the preputial opening is too small or has become contracted by inflammatory processes, thus constituting an obstruction to the ready exit of the normal or pathological secretions from the urethra. In small children the condition is often congenital. Circumcision is not dangerous in children when conducted by a properly experienced person and with appropriate precautions. The wound demands careful attention as regards cleanliness. After urination the surrounding parts should be washed, and the wound itself dressed with a salve or lotion, and covered with aseptic gauze. The application should never contain carbolic acid. See also Foreskin, Diseases of.

CIRRHOSIS.—See Liver, Diseases of.

CITRIC ACID.—A white, crystalline, acid compound, obtained principally from lemon-juice, but found also in smaller amounts in other acid fruits, as the orange and strawberry. The acid itself is seldom used in medicine, as lemon-juice seems to act better. As a preventative and curative agent in scurvy, lemon-juice is very valuable. It is sometimes given in rheumatism and in catarrhal jaundice. It is also frequently used to flavour medicinal mixtures, and to mask the taste of disagreeable drugs. Sometimes sick children can be persuaded to take water as freely as they ought to if it is given in the form of lemonade. Lemon-juice has a slightly stimulating effect on the kidney. It is of service also in the treatment of an irritable bladder, especially if such be due to an increased acidity of the urine, for lemon-juice makes the urine more alkaline. This is a fact contrary to the opinion of many superficial thinkers who advise against the use of acids because they increase the acidity of the blood. The acid of lemon-juice is readily oxidised, and causes the blood to be more alkaline.

CLAVICLE.—See Introductory Chapters (pp. 125–126).

CLEFT PALATE.—See Harelip and Cleft Palate.

CLIMATE AND DISEASE.—The relations between the effects of climate and the treatment of disease are very complex for at least two reasons: in the first place, because it is extremely difficult to define climate; and secondly, because the reaction to climate may vary within wide limits in different individuals. Thus, of two patients suffering from the same disease one may be benefited by a certain definite climate, and the other rendered worse.

The most ideal type of climate for a great majority of sick people may be said to be one in which there is a maximum amount of sunlight, a moderate amount of moisture, and one in general in which the atmosphere is free from dust. Much, however, depends upon the disease under consideration. For a climate might have all the ideal conditions that the mind of the physician might desire, and yet, by reason of difficulties of transportation and of obtaining food, proper housing, and protection, it might be badly adapted to the individual case. Thus, in many cases of tuberculosis, in which the disease is not advanced too far, certain arid regions of New Mexico and Arizona have shown themselves to be very desirable as regards climate; but until such places shall have been placed within the region of civilisation, and provided with good facilities for food supply, transportation, and nursing, they offer little hope except for those who can command all of the resources in spite of the difficulties.

A classification of climates is difficult to lay down. So many factors—such as pressure of the atmosphere, prevailing temperature, prevailing winds, average humidity, amount of electrification in the atmosphere, amount of sunlight, amount of rain, etc.—all contribute to the estimate of the general problem. There is no definite system for the classification of climates, since no region of the globe has an unvarying series of climatic conditions; and at best one can only approximate the general average. So that when one has to take into consideration not only the adaptability of the climate to the individual and the disease but the economic features as well, it often becomes a very perplexing problem.

There are practically no individuals, either sick or well, that are not benefited in some degree at least by change of residence under different climatic conditions. This applies particularly to those afflicted with certain disorders which are in part due to, or largely aggravated by, unhygienic climatic surroundings, such as tuberculosis, and by the various neuroses and neurasthenias so largely incidental to city dwellers. The most important diseases that can be benefited by climate are tuberculosis, neuroses, mild mental disturbances, chronic Bright's disease, chronic heart-disease, and, chronic bronchial disease. In tuberculosis, as has already been outlined, no general rule can be laid down. Patients with incipient tuberculosis can recover even in a London street, if they can be made to live twenty-four hours a day in the open air; and, on the other hand, patients die of tuberculosis even in the most favourable climatic surroundings and

with all the aids and accompaniments that a munificent purse can afford. In general, however, it may be said that patients with incipient tuberculosis should avoid the cities, where fierce winds are common, where draughts are rendered more acute by the flue-like character of many of the buildings, and where dust is extremely prevalent, particularly dust that contains many septic micro-organisms.

Tuberculous patients should avoid those climates where extreme changes are rapidly brought about, where the temperature falls 30 or 40 degrees in two or three hours and does it very often. They should seek a climate in which the sun shines much of the time, and where the humidity is not very marked ; in certain cases, complicated by bronchial conditions, the presence or absence of humidity may, however, be of service in allaying irritation of the bronchial mucous membranes. Having found such a climate, where increase of weight and decrease of temperature and cough are secured, every attention should be given to further the cure of the malady by the observance of hygienic and dietetic measures. Whether a patient should choose high altitudes or low, whether plains, forests, or lake regions, is a matter that should be determined for each and every individual by a physician who has paid particular attention to such climatic details. The following of general rules is often disastrous.

Neurasthenics often derive much benefit from climatic influences. Here the great desideratum is to obtain a climate in which the maximum amount of sunlight can be secured, where daily interests are such as to lead to healthful activity of the mind of the patient, and where freedom and absence from the haunts of men can be obtained. In the treatment of many neurasthenic conditions the assistance of a well-managed sanatorium is not to be disregarded, for helpful and sympathetic suggestion on the part of a well-trained physician who has devoted his best energies to this type of work is of paramount importance in the treatment of many neurasthenic states. These patients often do very well at the seashore. There the bathing, the interest in the ocean, and the general mildness of the atmosphere all contribute to bring about conditions of quiet and rest. Many also do well in moderately high altitudes, particularly after the acute stages of the illness have passed ; but, as a rule, high altitudes are disadvantageous to pronounced neurasthenics.

In the treatment of many kidney-diseases it is highly desirable that a warm, medium moist, and extremely equable climate be sought ; a climate in which moderate skin-activity is stimulated, thus relieving the kidneys of a certain portion of the burden of excretion. Climates in which sudden, abrupt changes of temperature are prevalent are to be especially avoided by sufferers of kidney-trouble ; but, as in the case of tuberculosis, and also of neurasthenia, the rules laid down are to be interpreted in the most general manner.

For chronic heart conditions it has been generally taught that high altitudes are undesirable, although there is no doubt that a number of heart-affections do well in relatively high altitudes. As a general rule, however, such patients feel more comfortable at lower altitudes, and in climates which are comparatively balmy, moderately moist, and with plenteous sunshine. A rolling, dry country, with moderate hill-climbing, and careful dietary, are particularly advisable.

As to the general problem of climate resorts or hotels, it is hardly within the province of a work of this kind to discuss. So many other factors, financial, social and otherwise, enter into the availability or non-availability of the different places, that the patient who feels himself in need of a climatic change should consult his physician in order to bring about the desired result.

CLOVES.—The unexpanded flowers of the *Eugenia aromatica*, a tree growing in the Molucca Islands, and cultivated in India, Ceylon, etc. Like other spices it is used largely for flavouring purposes, and for its stimulating and warming effect in colic, flatulence, and distention. It is sometimes given in consumption, and is said to control the cough and expectoration to some extent. Toothache may often be relieved by placing a pledget of cotton soaked in oil of cloves in the cavity of a decayed tooth. It is a good local application for crab-lice, and is sometimes used as a liniment. The dose of oil of cloves is about five drops, usually given in a capsule. Its active principle is a phenol (*eugenol*), found also in cinnamon oil.

CLUBFOOT.—A deformity in which the foot is directed inward and generally also downward (see Fig. 102). The deformity is often congenital, but may arise also by reason of the paralysis of certain muscles of the lower leg, and also in consequence of inflammations of the joints of the foot. If the affection is not treated, the foot remains directed inward, and the patients are compelled to step on the extreme edge of the foot. Patients with marked deformity must walk on the back of the foot. This causes extremely disagreeable callosities and ulcers on the foot, which heal with great difficulty. A very important question in the treatment of congenital clubfoot is the time to begin. Surgeons believe it best to operate as early as possible to accomplish a favourable result. By the time the child commences to walk, the affection should be corrected to such an extent that the sole, and not the outer edge of the foot, touches the ground. Treatment includes massage, bandages, and splints, especially with plaister jackets. If a clubfoot does not come under treatment until late, it requires the cutting of tendons and extensive operation to put the foot into the correct position.

COAL-GAS POISONING.—A characteristic type of poisoning cau ed by carbonic oxide, or carbon monoxide (CO), a poisonous, inflammable gas formed by incomplete combustion of carbon with oxygen. The development of this gas may be caused by heating with open coal-pans (as in

buildings under construction), or by too early closing of the damper, or by the stopping up of stovepipes. Carbonic oxide is contained also in illuminating-gas, especially in water-gas, which may escape into the living-rooms through leaks in the gas-pipes or through open gas-jets. It is found also in mines.

Carbonic oxide acts on the hæmoglobin of the blood in such a manner as to prevent the interchange of oxygen usually taking place in the blood. The important symptoms are headache, dizziness, tremors of the muscles, sounds in the ears, extreme weakness, and unconsciousness. The face is red to bluish. There may be convulsions and asphyxia (always in the severe

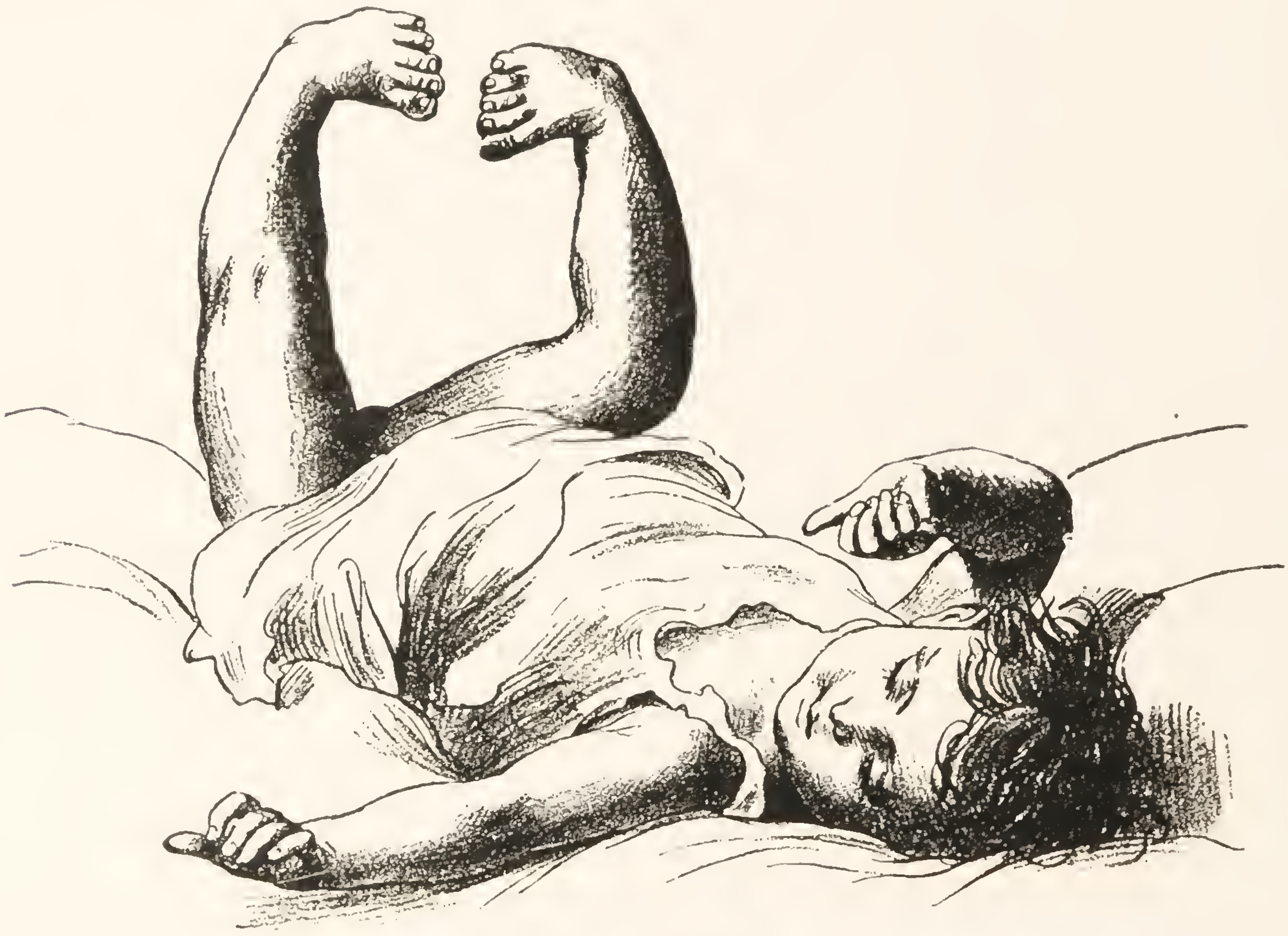


Fig. 102. Clubfoot.

cases), and death takes place, with small, slow pulse, from heart-paralysis and asphyxiation. Treatment consists in prompt removal of the patient into a pure atmosphere and in artificial respiration. It is imperative that the latter be started early and be perseveringly and unremittingly continued, even for hours. During the artificial respiration, heat, oxygen, infusion of hot salt water (1 per cent.) into the rectum, and hot coffee may be administered.

COCAINE-POISONING.—A morbid condition produced either by an overdose of cocaine, or by the continued use of the drug. The *acute* form of this disease is probably always caused by excessive medicinal doses of the remedy. The poisoned individual at first creates the impression of being under the influence of alcohol; this is followed by marked collapse, sometimes by convulsions. If the patients do not succumb within the first hour, they usually recover.

Much more important and frequent is the *chronic* form which occurs in those individuals who habitually indulge in the use of the drug. The vast majority of these victims acquire the habit through the use of the meretricious catarrh-cures so widely advertised, most of which contain this deadly poison. The affection manifests itself by bodily, but especially by mental, weakness. Loss of memory, disturbances of sight and hearing, fainting spells, loss of flesh and strength, and even severe mental disturbances are the most prominent symptoms. There is but one remedy for this form of poisoning—a living death, even more terrible in its effects than that due to morphine. This is the immediate and complete withdrawal of the drug. This, however, can be successfully accomplished only in an institution, as the unfortunate patients require careful supervision, owing to the occurrence of still more severe mental disturbances (often suicidal attempts) during the withdrawal of the drug. The public should be extremely cautious with regard to "catarrh-cures" of unknown composition; for many of these remedies, which purport to cure bodily ills, have not only no curative effect on the disease for which they are used, but in many cases are the direct cause of acquiring a lifelong habituation to a deadly drug.

COCCYGEAL PAIN.—A violent and stubborn pain at the lower extremity of the vertebral column, in the coccyx, and which is particularly aggravated by every movement of the bowels. If the trouble is caused by malignant ulcers or by bone ulceration, the only remedy is surgical interference. In most cases, however, it is the result of a fall or of a blow upon the parts in question. If hot compresses and hip-baths do not accomplish desired results, operation on the sacrum may be necessary.

CODEINE.—An alkaloid which, like morphine, is obtained from opium. It is a dimethyl-morphine. Codeine is generally used in the form of codeine sulphate, in doses of a quarter of a grain to a grain or two. It is used to quiet cough and produce sleep. Its effect is much more uncertain and less powerful than that of morphine, but it is not followed by the same distressing nausea, and is less apt to cause constipation. In diabetes it sometimes acts favourably when given in increased doses.

COD-LIVER OIL.—A complex oil obtained from the fresh or partly decomposed liver of the codfish. The oil is light to dark-red in colour, has a mild, fishy taste, and contains, in addition to various fats and their acids, small quantities of iodine. It also contains iodine compounds in combination with fats or proteids, or both. It is probable that the value of cod-liver oil is due to the fact that it represents a food which is readily assimilated, and which may contribute very materially to improve the state of nutrition in all wasting diseases of adults as well as of children, such as scrofula, tuberculosis, chlorosis, and anæmia, rickets, and diabetes mellitus. It should never be administered when the digestion is impaired. The most suitable time in the day to administer the oil is one or two hours after supper,

or between the meals of the day. In summer it is at times wise to omit its use entirely, especially when fresh cream can be obtained ; nor should it be given to children under six months of age, or to individuals with intestinal disease. To children it should be given at first in doses of a teaspoonful, gradually increased to four ; and to adults in doses of a tablespoonful, likewise increased gradually to four times that amount. Many cod-liver oil emulsions are more palatable than the pure oil. Their chief disadvantage is their comparatively high cost.

COFFEE.—The seeds of the coffee-tree (*Coffea Arabica*), two of which are contained in each cherry-like berry of the tree. From its home in Abyssinia and Arabia coffee has been introduced into the temperate and frigid zones, and has there become indispensable. Chemical analysis of the coffee-beans has shown them to contain, in the dry but unroasted state, 10 per cent. of water, 12 per cent. of nitrogen, 0·93 per cent. of caffeine, 9·5 per cent. of tannin, 12 per cent. of fat, and 12 per cent. of sugar. Roasting does not modify the amount of caffeine, nitrogen, or fat. The amount of sugar, however, is diminished to 1 per cent., and the amount of tannin increased. Aromatic oils are set free, contributing to the aroma of the coffee. Sugar assists in the formation of the caramel of the roasted bean. The roasting must be done uniformly, should not last too long, and the subsequent cooling must be a rapid and not a gradual one. Roasted coffee should be kept dry. When preparing the beverage, contact of the ground coffee with metal should be avoided, and only actually boiling water should be used in making the decoction, which should not be allowed to boil a second time.

The stimulating effect which coffee exerts on the nervous system is the reason for its widespread use and abuse. Coffee may be the enemy as well as the friend of man. As its abuse banishes sleep and causes restless nights, so it may also give rise to severe conditions of irritation of the nervous system, and through it affect the heart. Nor is it of secondary importance from the standpoint of digestion. For it is questionable whether even small quantities are beneficial to digestion ; and it is certain that the latter is partly or entirely interrupted by the indulgence in large quantities of coffee. Patients suffering from gout, in whom the stomach is generally also affected, had better forego the use of coffee. If the sensation of indolence following a plentiful meal appears to be lessened by a cup of coffee, this is not due to accelerated digestion, but to the stimulation exerted upon the brain. Many coffee substitutes are expensive, and furnish neither stimulation nor nutrition. The best substitute for coffee for the poor is a plate of hot soup.

COLCHICUM.—The root and seeds of *Colchicum autumnale*, or meadow saffron, a bulbous plant native to Europe. The active principle is an alkaloid called *colchicine*. Locally, colchicum is an active irritant ; and if taken in an overdose it may cause symptoms of violent inflammation of the

stomach and intestines, which may prove fatal. There is intense abdominal pain, salivation, nausea, vomiting, and diarrhœa, often accompanied by much straining and the passage of blood-streaked mucus. There may be giddiness, delirium, and collapse, or the patient may remain entirely conscious. In case of poisoning the stomach should be emptied if possible, and tannic acid given. The services of a physician are, of course, required. Colchicum is used principally in gout, and is very helpful in this condition. It is often combined with iodide of potash for use in chronic rheumatism. The wine of the seed is given in doses of half a teaspoonful.

COLDS.—As a means of protection against too marked a reduction of the temperature of the body—which normally is 98·6°F.—man is covered with skin. The adipose, or fatty tissue, which is found beneath the skin also contributes in this function. Fat, being a poor conductor, retains the body-heat and prevents too marked a reaction to the temperature of the environment, which, were it otherwise, might be injurious to the body. In temperate and frigid climates this layer of fat is not sufficient ; and hence clothes are necessary. These are likewise poor conductors of heat, and represent, as it were, an external layer of adipose tissue. The skin is supplied with numerous blood-vessels, which are kept in a certain state of contraction or of expansion by the nerves. If the skin is acted upon by variations in temperature, which are felt as cold or as heat, the nerves in the skin convey an impulse to the cord, from where impulses which cause either a narrowing or a dilatation are sent to the blood-vessels.

The stimulus of cold narrows the blood-vessels, causing less blood to flow through the skin. In this manner less blood is exposed to refrigeration, and thus too marked a cooling of the body is prevented. But if the blood-vessels do not contract rapidly on the stimulus of cold—that is, if they have lost their capacity of reaction ; as, for instance, in consequence of weakness—this self-protective mechanism of the body is impaired, and a large quantity of blood is cooled. The greatly refrigerated blood acts upon the internal organs and disturbs their activity, so that the many substances which should be excreted by these organs are retained in the body. As a result discomfort and chilliness, the first signs of a cold, manifest themselves. If there happens to be any organ which has been weakened by a previous disturbance, that organ will be the first to suffer from the consequences of the cold, and will become the seat of a fresh attack of congestion. This renewed weakening of the affected organ permits the colonisation of bacteria, which multiply, and thus may give rise to the various disorders resulting from exposure to cold.

In order to prevent a cold, it is important to maintain a healthy, well-nourished skin, which is rich in blood and capable of reacting to cold stimuli (see Hardening), and also to keep up a moderate layer of fat on the body. In the early treatment of a "cold" it is important to induce profuse action

of the blood-vessels of the skin, up to the point of sweat-formation ; this may be done by means of packs, hot baths, hot beverages, elder-tea, etc. The patient should also take an enforced rest, preferably in bed, in order to permit the readjustment of the circulation in the various organs of the body.

COLIC.—A painful state due to the spasmodic contraction of the muscles of any hollow organ of the body. It is particularly prevalent in the intestine, constituting a very annoying, sometimes even extremely painful manifestation of various disorders of the bowels. Here it is due to irritations of the wall of the intestine, caused by the presence of undigested food, by fermentation, or by inflammation. The presence of the gases of decomposing and fermenting food is one of the most potent factors in the production of intestinal colic, which is usually extremely severe if constipated masses prevent the egress of these gases. The characteristic of colic is its occurrence in acute attacks, the bowel being quiet during the intervals. The duration and intensity of these attacks may vary greatly according to the character of the original disease.

Colic is a very ambiguous symptom. It may be the manifestation of a simple irritation of the intestine, due to dietary indiscretions ; it may be due to a tumour narrowing the lumen of the bowel ; or it may be caused by adhesions of the intestine. It may, therefore, be of very little or of very serious importance in the individual case. In acute disorders colic passes off in a few hours or days ; but in chronic affections it may persist for months or years. A special form of intestinal colic is due to lead-poisoning. The incarceration of gall-stones and of renal stones in the bile-ducts or ureters is often accompanied by colicky pains.

Hot compresses to the abdomen, or over the site of the pain, act beneficially in most forms of colic ; relief is sometimes obtained also by hot hip-baths or full baths. Certain medicines are likewise capable of rapidly removing the irritative condition of the intestinal musculature, sometimes more rapidly than any other measure. Hot-water or soap enemas are particularly valuable in relieving colicky pains in the intestine. Later, when the violent pains have been allayed, it is necessary to treat the causative disorders.

COLLODION.—A solution of gun-cotton in alcohol and ether. It is a clear, colourless fluid of a syrupy consistency, and smelling strongly of ether. When painted over a part, the ether and alcohol evaporate, leaving a thin, transparent coating which serves as an air-tight dressing. Collodion is sometimes rendered more flexible by the addition of 5 per cent. of Canada turpentine and 3 per cent. of castor-oil. The film left by the evaporation of this mixture does not contract as does pure collodion, and is more likely to stay in position. Cantharides is sometimes applied in collodion. The strength may be varied to produce merely a reddening of the skin or

an actual blister. Collodion is very inflammable, and great care should be taken to keep it where children will not be likely to play with it.

COLOCYNTH.—The fruit of the *Citrullus colocynthis*, or bitter cucumber, deprived of its rind. The fruit is a round gourd about three inches in diameter. It is grown in many of the tropical countries. Colocynth is a purgative, producing a watery stool. It is used in conditions where it is desired to reduce the amount of water in the system, as in dropsy, or collections of fluid in the chest or abdomen. It is never used alone, but is always combined with other purgative drugs, being an ingredient in several well-known pills, such as the compound cathartic pill and the vegetable cathartic pill.

COLOUR-BLINDNESS.—Total or partial inability to perceive or to distinguish colours, usually a congenital and incurable defect. Acquired colour-blindness is a deep-seated affection of the eye, the recognition and treatment of which requires an exact medical examination. The congenital form of the affection usually manifests itself in inability to distinguish certain colours, red and green, for instance, being often confounded. In some cases the individual is altogether unable to recognise colours, everything appearing as grey on grey. The former defect is by far the more frequent one; the latter is very rare.

The faculty of recognising colours is of great practical importance, and railway-companies especially insist upon their employees possessing this ability, as the mistaking of the colours of signals may lead to frightful accidents. Railway and steamboat companies, therefore, demand that applicants for positions in their service be examined by oculists; colour-blindness precludes their appointment. The ability to recognise colours is of great importance in military service, also in the Navy. Many persons may never discover that they are colour-blind; others become aware of is only when they make a serious mistake in the selection of colours.

CONCEPTION.—See REPRODUCTION.

CONDYLOMA, BROAD.—See VENEREAL DISEASE.

CONGESTIONS TO THE HEAD.—See BRAIN, DISEASES OF.

CONIUM.—The leaves and fruit of *Conium maculatum*, or poison-hemlock, a small herb, originally a native of Europe, but now grown in America. It contains an active principle known as *coniine*. Conium is very little used as a medicine at present, interest in it centring chiefly in its poisonous qualities. It is related that Socrates met his death through the administration of this drug. Conium acts mainly by depressing the terminations of the motor nerves at their junction with the muscular tissue, causing paralysis.

CONJUNCTIVITIS.—See EYE, DISEASES OF.

CONSCIOUSNESS, DISTURBANCES OF.—Consciousness is the term applied to the conception entertained by an individual, not only regarding

his own personality, but also concerning time and space. A person can fulfil the duties of his daily life in a proper manner only when his consciousness is unrestricted and his will has free play. Disturbances of this faculty may result from various diseased conditions, and may vary considerably as to degree of severity.

Delirium is a state of confusion in which the patient's conception of time and space is very obscure. He is uncertain of his whereabouts, becomes erratic, does not recognise his usual surroundings, and is annoyed by various sensory disturbances. Not uncommonly he looks upon himself as a stranger, and refers to himself in the third person ; or he believes himself a new individual, because he has entirely forgotten everything that took place before his illness. When recovery takes place he may remain totally ignorant of the events which occurred during his sickness, so that, as a matter of fact, he leads a true double life. On the other hand, after having been visited by a number of attacks, the patient frequently is able to remember what occurred during previous ones. These conditions, which lead to a sort of "divided personality," have been largely made use of in fiction. They are often observed in that form of epilepsy in which the characteristic feature is a clouding of the intellect ; and they are associated also with hysteria, somnambulism, and with the hypnotic state. Compare the article on SLEEP.

Where the loss of consciousness advances to such a degree that the patient is unaware of certain natural processes in the system, the condition may be referred to as stupor, or stupefaction. Urine and fæces are voided involuntarily ; the act of swallowing is disturbed ; and the sensitiveness of the skin is diminished. As the result of lying constantly in one position, ulcers of various sizes may develop, especially at points of the skin where pressure occurs. The manner in which these may be avoided is described under SICK, NURSING OF. This condition of stupor is developed in the course of diseases which are accompanied by protracted, high fever, such as typhoid, and it may occur also in cerebral and mental affections. For complete loss of consciousness, see UNCONSCIOUSNESS.

CONSTIPATION.—A wide-spread disorder which occurs in both sexes, especially in women, and at all times of life. The disorder may exist without change for twenty or thirty years, owing to the carelessness of the patient. Some persons are troubled with constipation from infancy to old age. In babies it may occur as the result of congenital intestinal weakness ; but it is more apt to be due to a milk-diet. Constipation occurs most frequently in persons of thirty to fifty years of age, and on an average three out of every ten persons are affected by it. The causes of this disorder are to be found chiefly in the habits of life, especially in faulty diet and unhygienic ways of living. Regarding nourishment it may be said that a limited diet, particularly an exclusive meat-diet, is very undesirable. As the result of the overrating

of proteid foods in general, and of meat in particular, many individuals undervalue from their earliest years the beneficial effects derived from eating fruits and vegetables, giving these only secondary consideration. The musculature of the intestine thus loses the stimulation which a vegetable diet would give it. Proteid food leaves too little residue, giving the intestinal walls less work to perform ; their contractions become weaker and less frequent, and the result is a condition of intestinal inertia which is a constant cause of constipation. Insufficient bodily exercise is likewise a frequent factor, a sedentary occupation generally favouring the condition. In girls and women constipation is often caused by lacing, and also by carelessness in regard to the necessary evacuation of the intestine for reasons of prudery, convenience, etc. Permanent weakness of the intestinal tract may develop in consequence of another disease, particularly in many forms of stomach-trouble. Constipation may be superinduced also by the undue use of purges, so commonly resorted to without the advice of a physician, and which merely tend to still more increase the disability, until finally the condition becomes almost incurable. Some cases of constipation seemingly occur without any specific cause.

The underlying cause of constipation consists in a relaxation of the musculature of the intestinal walls, which have lost the ability to contract quickly and forcibly. Another form of constipation is due to a spasmodic and too forcible contraction of the intestine. This is the opposite of the first condition, and generally results from excessive irritation of the nerves of the intestinal musculature. It is believed by some that constipation may cause intestinal obstruction, but this view is not borne out by fact. A constipated condition lasting eight days or more would not affect the viability of the intestine. The intestinal content becomes dry and hard, and when finally passed it looks as if burnt ; it is dark-brown in colour, hard as stone, and is generally passed in separate knots or lumps, not unlike the excrement of sheep. These hard, round masses lie in the relaxed intestine, and must often be removed by artificial means. At times they form tumour-like swellings in the intestine, which may be felt through the abdominal walls.

The treatment of constipation is difficult, especially if the case is of long standing ; and it requires as much patience and energy on the part of the patient as from the physician. In order to be effective, the treatment often has to be continued for months and years. The first thing to do is to discontinue the use of all purges, as these over-stimulate the intestine, leaving it more sluggish afterwards. The patient must accustom himself to a fixed mode of living, and to take his meals at settled hours ; and he should go to the toilet regularly, the best time being on arising in the morning or immediately after breakfast. When the bowels show an inclination to move, they should never be restrained. A glass of cold water before breakfast

and before retiring acts as a sufficient stimulus for some persons. Plenty of brisk exercise, such as walking, hill-climbing, gymnastics, athletics, bicycle riding, etc., is advisable. See GYMNASTICS. Careful daily massage is also beneficial, especially the vibratory massage. See MASSAGE. Electrical treatment of the intestine is to be recommended, particularly as it may be combined with massage if proper electrodes are selected.

More important than this mechanical treatment is the use of a properly-selected vegetable diet. Meat and proteid foods should be taken in small quantities only; whereas fruit and vegetables, either raw or cooked, should be eaten three or four times a day, some early in the morning, and some before retiring. Grapes are especially to be recommended, and should be eaten at breakfast in quantities of from one-half to one pound. Of other important articles of diet for sufferers from constipaton, may be mentioned: honey, buttermilk (one pint before breakfast), sour milk, kephir, coarse bread, gingerbread, figs, dates, tart foods and drinks, all kinds of spices, herring-salad, pickles, spinach, lettuce, cabbage, cauliflower, etc. A detailed list should be given by the physician. Cocoa, chocolate, red wine, rice, sago, gruel, wheat bread, etc., are less valuable. The essential feature in the nourishment is that the patient eat often and much. Not to eat for fear of filling the intestine is an incorrect view. The diet must be coarse, firm, gritty, and voluminous in order to cause the intestinal muscles to contract, and to throw off the contents of the intestine. An excessive diet is to be recommended, especially in the beginning of the treatment. After regular movements have been established, the diet may be regulated. In connection with the treatment here outlined, cold hip-baths (48° to 36°F.) of two minutes' duration may be beneficial. Enemas of water, oil, glycerine, etc., should be used only in exceptional cases, and when prescribed by the physician.

CONSUMPTION.—See TUBERCULOSIS OF THE LUNGS.

CONTUSIONS.—Injuries brought about by blunt force, as by a blow, a knock, the falling of a heavy object upon some part of the body, squeezing, by being run over, or by a fall. The rupture of small blood-vessels nearly always taking place in such accidents, extravasations of blood under the skin (so-called "bruises") are brought about; or injuries of larger veins lead to the formation of blood-tumours. The blood that escapes from the vessels enters the skin, and discolours it into a dark blue. Gradually, by transformation of the blood-pigment, this colour changes into brown, green, and yellow. If the hæmorrhage is very deep-seated, the colour of the skin remains unchanged. Joints affected by a contusion become swollen and painful, and their movability is impaired. If sufficient force is used, muscles may be crushed, bones splintered, and sinews and arteries torn. Contusions affecting the skull, chest, or abdomen, may result in shock and injury of vital organs. An individual thus injured sinks to the ground in a

faint; he becomes unconscious, grows pale, and vomits. In some cases death takes place at once; in others, coughing and vomiting of blood occur, and blood is discharged with the urine. See also Brain, Concussion of.

Slight contusions are treated with cold compresses (water or lead-water) which must be frequently renewed; bruised limbs are placed in an elevated position, and firmly bandaged if necessary. Massage may be prescribed by the physician. The practice followed by many mothers, when a child injures its head by a fall, of immediately pressing the bruise with a spoon, is very appropriate. The pressure distributes the blood, and facilitates its absorption by the lymphatics, either preventing the discoloration from developing, or causing it to remain small. Hot or cold compresses subserve a similar end. Blood-tumours which suppurate should be opened, as otherwise blood-poisoning may result. For the treatment of wounds caused by contusions, see Wounds.

CONVULSIONS.—Localised or generalised spasms of the body, which may or may not be accompanied by loss of consciousness. To the laity a convulsion is a serious affair, and, as a rule, their judgment is justified, for the occurrence of a severe convulsive seizure is always indicative of some profound, if not dangerous, affection of the brain. But there are many causes for convulsions, and some indicate more serious disorders than others. It is not practicable in a work of this kind to outline all the possible forms of convulsions, so only the most important varieties will be discussed in this place.

Of the various causes for convulsive seizures, in the young especially, high temperature (*fever*) due to infectious diseases is one of the most important. The presence of *intestinal parasites* is also to be reckoned with. The *oncoming of infectious diseases* is often preceded by convulsive seizures. Other causes are *tetanus, hydrophobia, poisoning from drugs,* poisoning from *alcohol,* poisoning from *kidney-disease, puerperal eclampsia, apoplexy, brain tumour, general paresis* of the insane, *meningitis, epilepsy,* and *hysteria.* A few words might be said about the characteristic forms of convulsion as present in these various conditions.

In high fevers due to acute infectious diseases, such as measles, scarlet fever, typhoid fever, dysentery, etc., the effect of the temperature on the brain-tissue is such that generalised convulsions may occur. They occur practically only in children, and usually only when the temperature has been high for a considerable length of time. They are more prevalent in those children who show similar convulsions, or milder convulsive movements, at the beginning of an attack of infectious disease. The correct treatment for these is to reduce the temperature by proper bathing or sponging, and to have the bowels emptied as rapidly as possible.

Convulsions due to intestinal disturbances are by no means uncommon, and are often confused with true epilepsy because of their epileptiform

character. These also occur almost solely in young children. Over-eating, rapid eating, the presence of tapeworms, or even of pinworms, may induce these convulsive movements, usually associated with other signs of indigestion or of worms. Naturally, treatment would take into consideration the removal of the exciting cause by enemas, cathartics, etc.

A few specific infectious diseases are attended by very characteristic convulsive seizures. Typical of these are tetanus and hydrophobia. In these diseases there is a previous history of a wound or a dog bite, and later development of strong, tonic, muscular contractions. These tonic contractions differ from the ordinary contractions of epilepsy and hysteria by the rigidity of the muscle, the arm or leg or hand being drawn up tightly in one position and not alternately drawn up and extended. The characteristic forms of convulsions in tetanus and hydrophobia are described under RABIES and TETANUS.

Certain drugs have a peculiar action on nerve-tissue, causing irritation of the brain centres or spinal cord centres, with the production of convulsions. The most characteristic of these is strychnine, but drugs like calabar bean, cocaine, belladonna, and even codeine in children, may bring about convulsive movements. The convulsions of strychnine are very characteristic. They are tetanic in nature, that is of the tonic class, and are not accompanied with loss of consciousness. They involve the muscles of the jaw (causing lockjaw), the muscles of the back of the neck (drawing back the head), and the muscles of the spine (bowing the body backward). In severe cases the spasms are so marked that the body rests on the heels and head. The convulsive seizures of alcoholic poisoning are described in the article on ALCOHOLISM.

Kidney-disorders are apt to cause convulsive seizures because of the retention of poisonous products which should have been eliminated by those organs. The convulsions are epileptiform in their general character, as described in the paragraph on *Bright's disease* in the article on diseases of the KIDNEY. They do not differ in any essential particular from the convulsions known as eclamptic convulsions, which are frequently found as the result of insufficient kidney action in the period of child-bearing. See also ECLAMPSIA.

The peculiar convulsions of apoplexy are described under BRAIN, APOPLEXY OF. From that article it will be seen that at least three different effects are to be separated: one resulting from hæmorrhage into the brain substance; the second following stoppage of a blood-vessel of the brain without hæmorrhage; and the third caused by stoppage of the blood-current due to gradual occlusion of a vessel. In each and every one of these conditions, the result is due to the circumstance that a certain portion of the brain has been deprived of its blood supply. This area then becomes degenerated, breaks down, and constitutes a weak part of the nervous system.

The convulsions of apoplexy therefore vary according to the cause. They are usually associated with some degree of paralysis.

Brain tumours may produce generalised convulsions, but more frequently they cause localised convulsions of the type known as Jacksonian epilepsy. In this the arm or leg may become affected with a trembling or shaking, or may go through gross movements, the patient being fully conscious of what he is doing. See EPILEPSY.

In general paresis of the insane, the convulsions either resemble those of epilepsy or are typically apoplectic in character, being followed by a certain amount of paralysis of either side of the body. This paralysis is, as a rule, much more transient in general paresis than when due to apoplexy. Fuller descriptions of these attacks will be found in the article on BRAIN, SOFTENING OF.

The production of general convulsions in *meningitis* is usually accompanied with a very high temperature and very active delirium, occasionally with a stuporous state. These convulsions are not to be distinguished in general from those accompanying high fevers from other causes; but the presence of various jerkings of the muscles of the eye or face, and the localised disturbances of the large nerve-trunks at the base of the brain, may serve to separate meningitis from other febrile disorders.

The convulsions of epilepsy and hysteria are very similar, and affect both sexes. In epilepsy there is, however, usually a preliminary warning (or *aura*); the patient generally cries out; there is sudden loss of consciousness; and the patient falls, and very frequently either bites his tongue or bruises himself in some manner or other. The hysteric rarely hurts himself, although this is not an absolutely distinguishing feature. Further consideration of these forms of convulsion will likewise be found in their respective chapters.

The general treatment of any convulsive attack, pending a more accurate diagnosis of the cause, consists in loosening the clothing about the chest and neck to prevent strangulation, the use of wedges between the jaws if there is a tendency to injure the tongue in any manner, and giving the patient plenty of fresh air. The bowels should then be emptied rapidly by an enema. If the temperature is very high, it should be brought down by means of cold applications. If the convulsions continue, it may be necessary to give a little chloroform, but it is highly improbable that a layman would attempt to treat continuing convulsions without trained advice.

COPAIBA.—An oleoresin obtained from the *Copaiba Langsdorfii*, a large tree growing in Brazil. It is a yellowish, oily fluid, with a bitter, disagreeable taste. Copaiba has a stimulating effect on mucous membranes, particularly of the urinary tract. It is used in chronic bladder trouble, or in low-grade inflammations which show a tendency to become chronic, like the late stages of gonorrhœa. It is sometimes serviceable in chronic

bronchitis. The oil of copaiba is given in capsule or emulsion in eight or ten drop doses.

COPPER.—In medicine this metal is used only as copper sulphate or blue vitriol. This appears as clear, rhomboid crystals of a beautiful greenish-blue colour. Copper is locally very irritating, its chief use being as an emetic. An overdose causes violent inflammation of the stomach and intestine, with severe vomiting and diarrhœa, metallic taste in the mouth, salivation, colicky abdominal pain, and perhaps convulsions and death. Eggs, milk, or even soap should be given at once in large quantities, and if possible the yellow prussiate of potash should be administered, although it is better to use the former antidotes rather than to take time to procure the drug. The dose, used as an emetic, is five grains. Externally the crystal is used as a caustic.

CORNEA, DISEASES OF.—See Eye, Diseases of.

CORNS.—Thickenings of the horny layer of the skin, forming circular or oval callosities over a joint, usually over the little toe. The painfulness of the corn distinguishes it from other callosities. It is not situated as a smooth, horny layer upon the underlying part ; but a vitreous, thickened plug descends in root form, often containing remnants of former hemorrhages as black granules. These solid plugs press upon nerve-branches, and are therefore extremely sensitive to pressure. Corns are often confused with thickenings of mucous follicles over the ball of the big toe (bunions), which are of an inflammatory nature and lead to abscesses ; this happens rarely with corns unless an injury occurs when cutting them.

Corns are best treated with the aid of a 50 per cent. solution of potash-lye, which should be plentifully applied to the corn before any attempt is made to loosen the plug. It is advisable to scrape off layer after layer with a sharp knife rather than to cut, and to carefully loosen the last, innermost, horny substance with the point of the knife. In case of bleeding, lunar caustic or alum may be used. Great care must be taken to avoid infections. If such occur, and the toe becomes red and swollen, a physician should be consulted at once. A saturated solution of salicylic acid in collodion is a useful corn caustic. Its action is slow but effective, and not painful.

Corn-plaisters of caoutchouc, cotton, or leather, are merely preventives, and possess no curative value. Quacks and corn doctors have been responsible for the loss of many human lives by blood-poisoning, caused by lack of cleanliness in performing operations.

CORPULENCE.—See Obesity.

CORSET-LOBE LIVER.—See Dress.

CORYZA.—Cold in the head. This affection is of so frequent occurrence that everyone believes himself to be quite familiar with it, but it often leads to consequences which are difficult of recognition by the laity. Acute, chronic, and nervous coryzas are to be distinguished.

Acute coryza begins usually at night with a pricking irritation in the back of the naso-pharynx. There is an inclination to sneeze, and a sensation of fullness and heat in the nose. The secretion is sparse at first, and is often mixed with blood streaks. After six to eight hours it becomes looser and contains mucus ; later it turns yellowish-green, viscid, and resembling pus. Very frequently the secretion is watery. The duration of an attack of acute coryza varies from several days to weeks. After persisting for some time, it may lead to a profuse, yellowish, purulent, often malodorous, secretion ; when this occurs the accessory cavities of the nose (the maxillary and frontal sinus) become involved. This suppuration within the accessory cavities, which is usually accompanied by daily headache lasting for hours, may heal spontaneously, but occasionally it requires operative treatment.

In the chronic form of coryza, which may last indefinitely, the outflowing pus leads to the formation of polypi (see NOSE, POLYPI IN) and to obstruction of the nose. If an acute coryza extends to the larynx and the bronchi, it will result in hoarseness and cough. This annoying complication is a regular occurrence in some persons, especially in winter. Coryza may spread also to the naso-lachrymal canal, leading to running of the eyes and to catarrh of the mucous membrane of the eyelids (*conjunctivitis*). Its transmission to the ear causes pressure and a sensation of dullness, ringing in the ears, and difficulty of hearing ; it may even lead to inflammation of the middle ear. An acute coryza occurring in the course of an influenza—and such is the usual history—may be complicated by an extension from the middle ear to the mastoid cells, and from there the infection may spread to the meninges, causing a purulent meningitis. Mastoid complications are not infrequent, and are often very serious. They frequently require operative treatment.

Coryza of infants, if congenital and persistent, may be a serious sign of an infection of gonorrhœa or of syphilis. In small children, owing to the narrowness of the naso-pharyngeal space and to the width of the opening of the Eustachian tube, catarrhal inflammation of the nose may extend to the middle ear, where it may give rise to a purulent inflammation, causing great earache, and perforation of the drum. See EAR, DISEASES OF. Coryza in small children and infants is always a very troublesome disease, as many do not attempt to breathe through the mouth. They suffer, therefore, from shortness of breath, even from attacks of suffocation, and their ability to swallow is so impaired that it becomes difficult to feed them.

Countless remedies are recommended for the cure of coryza, but they do not deserve recognition. Smelling-salts and snuffing-powders prepared with menthol and camphor may afford relief ; but injections of cold water, alum solutions, etc., are absolutely dangerous. A steam-bath (breathing steam from a tall pitcher), if used on the first day of the affection, is

sometimes useful in suppressing a threatening coryza; but at a later stage of the disease it is ineffectual. The dry air of rooms, especially of steam-heated rooms, acts injuriously; whereas plenty of outdoor exercise in fresh, clear air is beneficial, even in the middle of a severe winter. If the disease is accompanied by severe headache, by profuse, persistent, and ill-smelling discharge, or by involvement of the ears, careful special treatment is required. The prevention of coryza, so far as it is an affection due to cold, may be accomplished by a general hardening of the body. See HARDENING. Stockings should be changed frequently, and wet foot-wear promptly removed, especially in the case of children.

Nervous coryza consists in an intense irritation accompanied by sneezing, and by a profuse watery (never viscid or purulent) secretion; it begins abruptly and ceases as suddenly. During the intervals between the attacks, the state of health is usually normal. The affection generally begins early in the morning, as soon as a part of the body is uncovered, and lasts for from several minutes to two hours. The eyes are often watery. In some individuals the inclination to sneeze appears when they pass from one room into another with different temperature, or when they smell certain substances, as roses, or hay. See HAY-FEVER. Some persons are affected when travelling on railways ("railway coryza"); and others when in a crowd, or when looking into brilliant light. All persons suffering from nervous coryza, which is related to asthma, are themselves nervous; and in order to be cured permanently of coryza they must undergo a general treatment calculated to improve their nervous tone. This will cause a diminution of the excessive sensibility of their mucous membranes. Morbid changes in the nose are present in some cases; and the removal of these will cure the affection.

COUGH.—A sudden, violent, spasmodic, and noisy expulsion of air through the closed glottis after a preceding deep inspiration. It is a reflex, having for its object the removal of some disturbing substance (mucus, etc.) from the respiratory passages. Hawking is a voluntary cough. Moist coughs are those in which fluid masses are expectorated. Dry, or irritative, coughs are accompanied by little or no expectoration. The irritation in a dry cough may originate either in the larynx or in other portions of the respiratory passages. It may be due to some abnormal process in the pharynx, or in the uvula, or even in organs which have no direct association with the respiratory passages, as the liver, stomach, intestine, womb, teeth, or ear. In such cases it is a question of referred sensation. The irritation, in some instances originating in an affected organ (for instance in the mucous membrane of the stomach), acts upon the pneumogastric nerve, which, being in close relationship with the larynx and the bronchi, transmits the impulse to cough (see Plate XI.). If the larynx and the upper portions of the trachea are affected, the cough is usually accompanied with a

peculiar, shrill noise, or hoarse sound. In laryngeal croup this peculiarity is so pronounced that the initiated can recognise the disease from the character of the cough alone. Cough is frequently preceded by a sensation of tickling in the larynx.

Cough is merely a symptom of an abnormal process, and occurs, as stated, in a great many different affections. It is, therefore, not only out of place, but often actually harmful to use any of the innumerable varieties of cough remedies on the market in the hope of curing an affection with them. A cough frequently masks a serious disease, and the employment of a cough remedy very often masks the symptom which it is essential to know if the

FIG. 103. Fresh Pond Crematory, Fresh Pond, Long Island, N.Y.

original malady is to be cured. This is particularly true in consumption. Many patients with this affection take cough remedies which conceal their true condition from themselves and friends until it is too late to be able to do anything for them. The indiscriminate use of cough remedies is responsible for the death of many individuals who might have been saved.

CRAB-LOUSE.—See LICE.

CREMATION.—The disposal of the dead by burning. This method has gradually become recognised of recent years, and a great number of crematories are now in use throughout the world. The objections raised by clergymen and jurists against cremation cannot be considered valid, and it is merely just to leave it at the option of everyone whether he prefers to have his body subjected to slow decomposition in the earth or to a rapid dissolution by heat.

Very erroneous, even discouraging, ideas are disseminated among the public regarding the method of cremation. It is believed that the body is

surrounded by flames, and that it burns with a blaze. Such is not the case. Fig. 103 shows the exterior of a crematory, the chapel; and Fig. 104 represents its inside apparatus. The process of cremation is as follows: The coffin is placed on a platform (*a*) in the chapel of the crematory, and when the funeral service is over it gradually disappears from the view of the mourners through a noiselessly moving trap-door, while, at the same time, the opening in the floor is closed without noise. As soon as the coffin has reached the lower storey, the wreaths are removed from it, and it is introduced into the crematory proper by means of a small, specially constructed iron carriage. About four to five hours previously the apparatus, especially its superstructure, has been heated sufficiently by means of gases developed in the generator to the left of the incineration chamber. As soon as it is

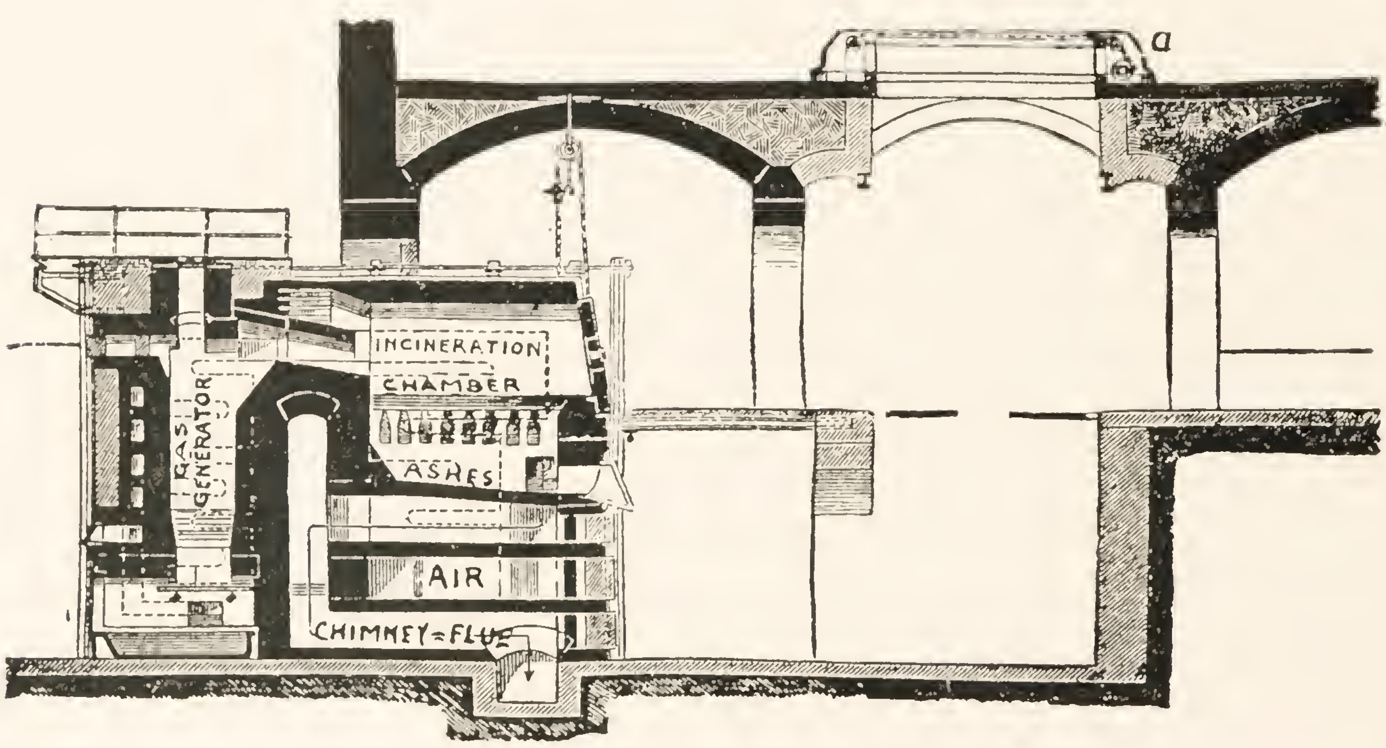


Fig. 104. Cross-section of an incineration apparatus.

intended that the incineration should commence, the development of gas is interrupted, and atmospheric air, which causes the combustion of the body, is freely admitted by the opening of slides through which only air that has been heated up to about 2100° F. enters the crematory. The superheated air surrounds the body and dissolves it, complete combustion taking place between the body-gases and the air. The colourless and odourless gaseous products of the combustion pass through separate channels, being gradually cooled off until they escape through the chimney. The only residue of the combustion is a small quantity of whitish-grey, readily crumbling particles of bone, which fall through a grate into the space for ashes below the incineration chamber. After having been permitted to cool for about an hour, the ashes are placed in an appropriate receptacle, which is soldered, supplied with the name of the dead, and preserved in an urn. The incineration of the body of an adult, which generally is left in the casket, lasts on an average from an hour and a quarter to an hour and a half. Cremation is a much more hygienic method of disposal of the dead than burying.

CREOLINE.—A dark-brown, syrupy fluid obtained from the distillation of coal-tar. It is used as an emulsion in water, forming a slippery, opaque mixture, with quite a strong odour of carbolic acid. Creoline is strongly antiseptic, and is commonly used as a vaginal douche in 1 or 2 per cent. solutions. It is sometimes used to wash out the bowel in dysentery, and is of service in certain eye and ear conditions. Creoline is poisonous, and should not be used without the advice of a physician.

CREOSOTE.—A brownish, oily fluid, obtained for medicinal purposes by the destructive distillation of beechwood. Its chief constituents are guaiacol and creosol, and its action much resembles that of carbolic acid. It has a peculiar smoky odour and taste. An overdose causes symptoms like those of carbolic acid poisoning, and the treatment is the same. Creosote is used in consumption and chronic bronchitis, but it is very apt to upset the stomach. It is sometimes given to prevent fermentation in digestive disturbances. Applied on a little cotton to the cavity of an aching tooth, creosote will often give immediate relief. The dose is one to four drops.

CRETINISM.—See Imbecility; Thyroid Gland, Diseases of.

CROTON-OIL.—A pale yellow oil obtained from the *Croton tiglium*, a small tree of India. It is exceedingly irritating locally, and is one of the quickest purgative agents used in medicine. It is given in a little olive-oil or butter, being placed on the back of the tongue. One or two drops will very soon produce a large, watery stool. It is, therefore, valuable when the patient is unconscious and it is desired to move the bowels quickly and thoroughly, as in apoplexy or uræmia. Externally, it is used to produce a blister, or in more dilute form as a counter-irritant for sprains, muscular rheumatism, etc. Overdoses cause inflammation of the stomach and intestines.

CROUP.—See Diphtheria; Larynx, Diseases of.

CUBEBS.—The unripe fruit of the *Piper Cubeba*, a plant found in Java. The berries are little, black, rough spheres, about the size of peas, having a peculiar taste. The oil, or oleoresin, of cubebs is used in late stages of gonorrhœa and in bronchitis. Sometimes dried berries are smoked with tobacco. The dose of the oil is five to twenty drops. An over-dose acts as an irritant to the alimentary and urinary tracts.

CUPPING-GLASSES.—Instruments used for purposes of counter-irritation by drawing small quantities of blood to the skin. Cupping does not draw fluids from deeper organs. Its action is purely a local one, and its benefits are due to purely nervous influences. There are two methods of cupping, dry and wet. Dry cupping-glasses are small vessels with thickened edges. In order to rarefy the air in them, they are warmed over an alcohol flame, and then rapidly pressed against the skin (see Fig. 105), to which they remain adhering, gradually drawing blood to the surface and causing the skin to become red. By the application of a number of such cupping-glasses, it is possible to increase the blood contents of a large area

of skin. The irritation becomes more effective if the dry cupping is combined with the wet method, in that small incisions are made in the skin before the cupping-glass is applied. To produce a great number of small incisions closely together, a so-called spring-lancet is used. This consists of a square metal plate provided with numerous openings, from which small knives spring out automatically upon pressing a button. By placing this instrument on the skin and operating the spring, the knives will make numerous small incisions in the skin, causing blood to flow. A preliminary condition of wet cupping is the most scrupulous disinfection of the instrument and of the skin. Wet cupping has little advantage over the dry method, save in the treatment of local effusions about joints.

FIG. 105. Cupping-glasses. Upper figure shows method of heating the air inside a cup to cause a partial vacuum. Lower figure shows cup applied to the skin.

CYANIDE OF POTASSIUM POISONING.—A very acute form of poisoning, which is of frequent occurrence, owing to the widespread commercial employment of the drug. Death usually takes place within a few minutes after the ingestion of a fatal dose ; and very little can be accomplished by the administration of antidotes. The treatment consists in immediate production of vomiting and the giving of cold douches while the patient is in a warm bath. The victim usually utters a cry of anguish and falls prostrate, dying within a few minutes ; or there may be nausea, vomiting, and difficulty in breathing, followed by convulsions, trismus (lockjaw), and finally a deep coma. In rare cases, the patient may emerge from the state of coma within a few hours, and then go on to complete recovery. Artificial respiration is of service ; also bleeding. The poisoning results from changes in the blood, whereby the hæmoglobin is rendered unable to give up its oxygen.

CYANOSIS.—Term applied to a bluish discoloration of the skin and of the visible mucous membranes. This symptom is observed in all diseases where circulatory or respiratory interferences are present ; as, for instance, in cardiac and pulmonary affections. It is found also in cases of systemic poisoning, by which the conversion of venous blood (dark blood, with diminished oxygen) into arterial blood (bright red blood, rich in oxygen) has been prevented. Treatment of this condition must be directed to the disease or factor which is the exciting cause.

CYSTITIS.—See BLADDER, DISEASES OF.

D

DANDRUFF.—See ERUPTIONS; HAIR, CARE OF.

DEAD, DISPOSAL OF.—Owing to the more or less rapid disintegration of the body after death, the corpse becomes a menace to health. Hence the earliest possible removal of the corpse from the dwelling is necessary, especially when the extent of the residence is limited, or when the deceased has died of an infectious disease. A mortuary serves as a place to keep the dead body until its final disposal.

The opinion prevailing among the public that a cemetery can give rise to the propagation of infectious diseases is erroneous, upon the whole, since the disease-germs entering the earth with the dead body soon perish there. At most, objections might be raised to the use of water from graveyard wells for drinking purposes. Cremation of the dead has lately become customary to some extent. Forceful reasons of a hygienic nature that recommend cremation in preference to interment do not generally exist. Cremation is preferable in times of epidemics of infectious diseases. Extraneous reasons favour the destruction of the dead by fire, especially in large cities, as, for want of suitable space, the burial places must be moved further and further away from the cities, causing the transportation of the dead to become tedious and expensive.

DEAF-DUMBNESS.—See SPEECH DISTURBANCES.

DEAFNESS.—Inability to perceive sounds; a condition which may affect one or both ears. Defective hearing of severe grade is often confounded with deafness. The usual causes of deafness are serious and incurable changes in the labyrinth. Cases of hysteria may be accompanied with deafness of one or both ears, but, as a rule, these cases are quickly cured. Unilateral deafness is difficult to demonstrate by examination. Congenital deafness, or deafness acquired in early childhood, leads to muteness. See SPEECH DISTURBANCES. Vertigo frequently accompanies deafness.

Deafness appearing suddenly, and accompanied by dizziness and vomiting, is the result of a disease of the labyrinth (Menière's Disease) which is rarely cured. See EAR, DISEASES OF.

DEATH.—The cessation of life is not always ushered in by gradual diminution of consciousness, but often occurs with unimpaired consciousness. At times death comes as a gentle slumber; at other times it is accompanied by severe struggles. When death occurs, it is the duty of faithful nurses to act with presence of mind and with consideration. The last moments ought not to be made more difficult by painful expressions of grief on the part of the relatives. Quiet and consolation should surround the dying person. He should be kept clean and comfortable until he has drawn his last breath, and even after that. The lips should be moistened

with water or with fruit-juice, the perspiration wiped away, and every wish of the dying person carefully listened to and fulfilled if possible.

After death the corpse should be laid on its back and cleansed. It should be dressed without delay before rigidity sets in ; otherwise dressing is difficult. The hair should be arranged, the eyelids closed softly, and the open mouth closed with a cloth drawn around the head and under the chin. The corpse should be covered with a shroud. In the summer-time chloride of lime may be sprinkled over the body, or the shroud which covers the body may be packed with salt and ice. The windows of the room in which the body lies may be opened, especially when the weather is cool. For evidences of death, see Death, Apparent.

DEATH, APPARENT.—The manifestations of life, especially those of the respiration and heart-beat, are sometimes reduced to such a degree that it appears as if life were extinct. The skin is cool to the touch and entirely devoid of colour ; no muscle is moved ; respiration is suspended so far as the eyes are able to observe ; and the pulse cannot be felt. And yet the differentiation between death and apparent death is of the utmost importance, because attempts at resuscitation must be made so long as death is not demonstrated beyond any question of a doubt, especially in persons who have met with accidents.

The danger of being buried alive is scarcely ever present, as burial under ordinary circumstances takes place at a time when the signs of death are obvious. The latter are: bluish-red, dirty-red, or rose-red death-spots upon the dependent parts of the body, particularly upon the back ; the eyelids remaining open when drawn apart ; cloudiness and folds in the horny layer of the eyes ; greenish discoloration of the skin in the soft parts of the body ; cadaveric rigidity, which generally occurs twelve hours after death, lasting from 24 to 48 hours ; and lowering of the temperature of the body to below 80° F., taken in the rectum.

If these sure signs are absent, it is necessary to make more certain, even if the respiration and pulse are no longer noticeable. Death has occurred if, upon constriction of a finger or a toe with a thread, the skin of the constricted part does not discolour to a distinct red, and later, blue ; if, further, upon dripping hot water or sealing-wax upon the chest, the skin is not reddened, but if at once a blister is formed which bursts rapidly, showing a colourless background. In cases which even then remain doubtful, further guarantee is furnished by the electric current. This test, however, requires expert knowledge. In cases where suspicion exists that death is only apparent, a thorough examination should be made to discover the possible cause. It is occasionally noted that the position of limbs changes after death. This is due to the rapid onset of post-mortem rigidity, and it is by no means a sign that the patient has been alive. Changes of position of the corpse in the coffin are to be explained by the movements due to post-mortem rigidity.

DELIRIUM.—A condition of mental confusion, characterised by numerous and rapidly-changing hallucinations. The patient views his surroundings as through a veil ; he is unable to locate himself, as it were ; and as the hallucinations are often of a threatening nature, and inspire him with fear, he is in a state of constant uncertainty and fright. He becomes very much excited, and uses force against his supposed enemies. Sometimes these patients are of a happy and joyous disposition ; they have visions of flowers and gay colours, and hear ravishing music. A state of delirium may follow extreme bodily exhaustion, such as may be produced by severe hæmorrhage or by continued thirst or hunger (the vision of the "fata morgana" in the desert). It may occur also after intoxication by opium, hashish, or alcohol, and during severe attacks of fever. Certain forms of delirium, as, for instance, the visions of religious maniacs, are caused by psychic excitement ; other forms occur during attacks of hysteria or epilepsy. Delirious states are transitory, but may remain for hours or days. It is scarcely necessary to add that such patients require constant watching.

DELIRIUM TREMENS.—See Alcoholism.

DELUSIONS.—See Insanity ; Mental Diseases.

DEMENTIA PRÆCOX.—See Insanity.

DENGUE FEVER.—A tropical disease, which runs an acute course and is very contagious. It is endemic in the Lesser Antilles, along the coast of the Red Sea, and on the West Coast of Africa. From time to time the disease invades other countries. It has occurred in the southern United States ; and an epidemic of dengue raged in Philadelphia in 1798. The disease begins, after three to five days of incubation, with sudden fever, general indisposition, pains in the head, joints, and limbs, catarrhal symptoms, and a transitory rash which extends over the entire body in the form of a diffuse redness or red patches. A favourite site of the pain is in the knee-joints. This pain becomes worse on walking, and gives rise to a peculiar strutting gait which is characteristic of the disease, and which has given it the popular name of "dandy fever." The fever, which may rise as high as 106° to 107° F., usually disappears in about three days, together with the other symptoms, this stage being marked by a profuse perspiration. A day or two later, however, a second eruption may take place, which is uncertain in character, and may resemble measles, scarlatina, urticaria, or other rashes. This second eruption may last anywhere from a few hours to several days ; recovery follows its disappearance, although a complete return to health may be greatly retarded.

The course of the disease is, as a rule, favourable. Fatal cases are rare, and occur mostly in children or in persons afflicted with some other severe illness. Such persons should, therefore, be especially protected against infection during the prevalence of an epidemic ; and in order to avoid actual contact with the subjects of the disease they had best be removed

from their homes for a time. The disease is extremely contagious, sometimes spreading even more rapidly than influenza. Epidemics have been rare within recent years.

DENTISTRY.—See Teeth, Care of.

DIABETES INSIPIDUS.—A condition in which very large quantities of extremely thin urine are discharged. In cases of medium severity the quantity may vary from six to seven quarts in a day, but in severe cases it may increase to twice these amounts or more. In contrast to diabetes mellitus and to chronic inflammation of the kidneys, in which the quantity of the urine is generally also increased, the urine discharged in this disease does not contain any morbid constituents. In keeping with the great excretion, there is great thirst. As the supply of water rarely keeps up with the excretion, the tissues of the body become impoverished in water. This is made manifest by dry skin and by the absence of all perspiration. Whereas mild or medium degrees of the disorder are frequently borne for decades without any marked disturbances, a certain loss of strength always becomes manifest when the disease increases in severity.

Diabetes insipidus, which is a very rare affection, generally appears very suddenly. Sometimes it accompanies the afflicted individual for life ; at other times it disappears after a shorter or longer period. The real causes of the disease are not known. It develops most frequently in connection with other affections, such as influenza, pneumonia, typhoid fever, scarlatina, etc. In some instances the disease is thought to be due to an affection of certain areas of the brain, but in the majority of patients there is no cerebral disorder. Treatment consists in careful nutrition, intended to counteract the threatening loss of strength, with simultaneous careful attention to all other measures calculated to improve the condition of the body. Favourable results have been obtained in some instances by a very gradual restriction of the over-abundant supply of water. This, however, is a double-edged measure, upon which one should never decide without the most careful medical surveillance. Not much is to be expected of medicines. The disease is by no means incurable, even if many cases are so malignant from the very beginning that they are refractory to all treatment.

DIABETES MELLITUS.—True diabetes ; a disease characterised by the excretion of grape-sugar with the urine. Persons in whom the metabolic processes fail to make use of all the sugar and sugar-forming food which they eat, and who excrete part of this sugar with their urine, are designated as diabetic. There are two types of diabetes, a mild and a severe form. In the mild form, sugar is excreted only when sugar or articles closely allied to sugar (particularly starch and flour) are consumed. In the severe form, sugar is excreted independent of the above-mentioned articles of food, and seems to be developed from the proteids of the body. In cases of chronic diabetic disease, there are other chemical changes in the urine ; and such

may also occur from inadequate treatment. The sugar contained in the urine is grape-sugar, so called because it was first found in fruits, particularly in grapes. Its fermentation causes the formation of the well-known spirits of wine. This sugar is a normal constituent of the tissue-juices and blood of animals. The remote causes of diabetes are as yet unknown, but it has been discovered that the disease stands in close relation to changes in the pancreas and to various diseases of the nervous system. From a practical standpoint, the question of inheritance is of great importance.

According to statistics, diabetes occurs at present more frequently than formerly, a fact which may, with some justice, be accounted for by the increased demand made upon the nervous system by the modern way of living. The largest number of cases occur after the age of 45 years, and, contrary to most other diseases, the course is then slower and milder than when the disease appears in youth. The disease usually begins insidiously, and almost without exception in a mild form ; if neglected, although sometimes also in spite of careful treatment, this develops into a severe and dangerous type.

The disorder has many symptoms, which may vary with each case. The most important of these are : Increased thirst, increased quantity of urine, loss in weight, unusual fatigue after exertion, mild and wandering pains in the muscles of the back and in the limbs, nerve pains (particularly in the hips and legs), spasms in the calves at night, diminished sexual desire in man, itching sensation and moist eruptions on the sexual parts of the woman, loosening of the teeth, receding of the gums around the incisors, weakening of the power of sight, and abscesses of the skin (so-called furuncles). These and similar symptoms are not necessarily all present, but they frequently alternate, one coming and another going. If only one symptom is considered, it frequently happens that the disease is not recognised, and therefore incorrectly treated. It is therefore necessary, if one of the mentioned symptoms is present, or if there be any other health disturbance of doubtful origin, to have the urine examined for sugar. The best time for such an examination is three hours after a plentiful meal of bread, milk, and sugar. The night urine must not be taken for this purpose, for frequently it contains no sugar, even if much sugar is excreted during the day. Sugar is often found in the urine of patients who complain of nerve pains which were supposed to have resulted from a simple cold. Early recognition of the disorder is therefore important, firstly, in order to cure the disease if possible, or at least to prevent aggravation of the condition by proper regulation of the mode of living; and, secondly, because neglect means the development of the severe type of the affection, or the accompaniment of dangerous complications, such as falling out of the teeth, cataract, gangrene of the feet, inflammation of the cellular tissues, arterio-sclerosis, and heart weakness. The patient generally succumbs to these

complications, or to the increasing weakness, or to a peculiar brain paralysis ; in some cases after one or two years, but more often after the disease has lasted a decade or longer.

As has been remarked, there are malignant types of diabetes which defy all treatment. In the majority of cases, however, the course of the disease is materially influenced by proper treatment, which generally succeeds in averting the dangers, either permanently or for a long time. Too credulous diabetics are overrun with advertisements of remedies supposed to have fabulous success. These, however, are worthless, and only serve to fill the purse of the unscrupulous manufacturer. Owing to the conspicuous advertising, some of these remedies have even deceived physicians. In view of this fact it must be emphasised that there is no sure remedy for diabetes, even if medicine can and must be given for single disturbances.

Treatment is, above all else, dietary. A proper division of rest and work, fresh air, muscular exercise, baths and other applications of water, light, heat, and cold, which act beneficially upon the general condition, are also of importance ; but the welfare of the patient depends essentially upon the character of the nourishment. The fundamental principle in this respect is to limit the amount of sugar-producing articles allowed the patient until no more sugar is excreted. If this is not feasible on account of its effect upon the general well-being of the patient and upon the digestive organs, the limitation of the sugar-producing articles should at least be carried to a certain degree. Just to what extent this may be done can be determined only after careful examination, which demonstrates that each diabetic needs a special allowance of sugar-producing foods suitable for his individual case. If this specialisation is not carried out, but a general scheme of treatment adhered to, the result is more harmful than beneficial. Of late, since this fact has been recognised, it has become customary to send diabetics to special institutions or to well-regulated hospitals, where exact observation may be made of the sugar excretion and of the influence exerted thereon by the nourishment, and where the patients may learn to live in accordance with the requirements of their condition. For patients whose circumstances permit it, summer cures at certain health resorts are advisable. In Europe the well-known watering place of Carlsbad holds first rank, although of late Homburg and Neuenahr are also much frequented by diabetics. In the United States, Mt. Clemens, Virginia Hot Springs, and Alma Springs are well thought of. The institutions, however, cannot be replaced by such spas and therapeutic cures ; and if only one procedure is possible, a stay in a suitable sanatorium or hospital should be given the preference.

With regard to the diet, patients should be provided with a list on which the articles of nourishment are divided into groups. The first division embraces foods which, accorded in judicious quantities, are the foundation of the diet. This group contains all kinds of meat, eggs, and cheese, most

vegetables, and all fat substances; the last-named are most valuable, especially butter. A second division includes foods which are to be totally excluded, such as all sugars and foods containing sugar (as honey, syrup, chocolate, sweetened fruits, fruit ices, etc.). If sweetening of the drinks or food cannot be dispensed with, certain substances may be used which have the virtue of tasting sweet even in small quantity, and which do not harm the body. Of these there are several kinds, the most useful being saccharine and crystallose. These are bought in the form of minute pills or tablets, one of which possesses the sweetening effect of an ordinary lump of sugar. A third group includes foods which, although containing sugar-forming material, cannot be entirely dispensed with. Such are bread, potatoes, leguminous plants, rice, barley, oats, milk, and fruit. After a careful physical and chemical examination, the family physician should give the necessary directions to each patient as to the quantity to be eaten. The most difficult part of the diet to regulate is the quantity of bread and fruit, as both are very important for the well-being of the body, and particularly for the organs of digestion. Special breads are made for diabetics. These contain less flour and more albumen than the ordinary kind. The best known are the aleuronat breads, the gluten breads, and various kinds of pastry made by special processes of manufacture. With these products it is easier to satisfy the patient's craving for bread, without harm from excess, than with the ordinary wheat and rye breads. These special kinds of bread are more expensive than ordinary breads; in fact, the entire diet required for a diabetic is more expensive than an ordinary diet.

Of late, fruit has been recognised as a useful addition to the diet of a diabetic. Certain fruits contain very little sugar; for instance, sour apples, sour cherries, early oranges, cranberries, and huckleberries. On the other hand, many fruits, as usually prepared, are so rich in sugar that they should be given only in the smallest quantities and only in mild cases. As in the case of bread, attempts have been made to diminish the quantity of sugar in preparing fruits for the use of diabetics. Similar attempts have been successfully made with drinks, particularly with sparkling wines. These may be found free from sugar in almost all large distilleries. Regarding alcoholic drinks the patient may not choose for himself, but must obtain advice, the same as for the necessary articles of nourishment. This applies especially to beers. Small quantities of light, thin beer are generally permissible; the actual quantity will differ in each case. As a rule, the light, mild, domestic beers deserve the preference, as they are much poorer in sugar than the renowned Pilsener beer or the darker, sweeter beers.

Thus it will be seen that there are many details to be observed in the diet of a diabetic in order to accomplish the desired result — to keep up the nutrition of the body while excluding an excess of carbohydrates, which class of foodstuffs are not oxidised by the body as they should be.

DIAPHORETICS.—See Domestic Remedies.

DIARRHŒA.—See Intestines, Diseases of.

DIASTASE.—A ferment, or enzyme, found in many of the lower plants, moulds, etc., but obtained commercially for the most part from various grains, notably barley. This ferment, or enzyme, has the property of digesting carbohydrates, notably starch ; and in its commercial forms, as malt extract, it serves a useful purpose in the treatment of starchy indigestion.

DIET FOR THE SICK.—The nourishment of sick patients is often one of the most difficult of subjects. The seriously sick should be given only such nourishment as is permitted by the family physician. It should be left to him, or to the nurse under his directions, to select the food. If his directions are carefully carried out the patient will not be overfed, nor will he be deprived of what is necessary, or given things that are harmful. The manner of serving the prescribed food to the patient is also very important. Above all, it must be appetising. It is essential, therefore, to pay attention to the thorough cleanliness of the dishes, glasses, plates, etc., and to the proper temperature of the food and beverages. If they are to be warm, the proper temperature is 104° F. The food should not be placed in masses upon one plate, as daintiness of service is of much importance in stimulating a jaded appetite.

Bedridden patients require an eating-board, and should be propped up with pillows while eating, so that they may enjoy their food in a raised position. Very weak patients should be hand fed. It is inadvisable to give them more than one teaspoonful at a time ; and this should be given with the right hand, while the left arm reaches under the pillow and raises the patient's head. This feeding should be done at intervals of not more than two to three hours ; also at night whenever the patient complains of dryness in the mouth and is troubled by sleeplessness. If ice is ordered, the fragments should be small, and should be administered in a teaspoon. Toothless old persons, small children, and patients who are not able to chew, should be given food macerated in milk, or finely minced. To prevent the spilling of fluids by the patients, special feeding cups provided with a beak are very useful. Glass tubes are also serviceable. If a patient is unconscious, his head should be turned to one side, the corner of the mouth opened with a finger, and the food given in a teaspoon. Frequent cleansing of the mouth is important, especially in those that are seriously sick. This can be done with a cotton swab wrapped about the little finger.

DIGESTION.—See Introductory Chapters (pp. 145-150).

DIGITALIS.—The dried leaves of foxglove (*Digitalis purpurea*), a widely cultivated European plant. It is extensively grown in the United States, but more for ornament than for commercial purposes. The active principles in the leaves are glycosides, four of which are described at the present time. The details of their composition, however, can be best

consulted in technical works. The action of digitalis is very complex. It is extremely bitter and irritating to the stomach, and some persons with delicate stomachs are unable to take it. It is absorbed very slowly from the stomach, and has a very pronounced action on the heart and its nervous mechanism. The principal effect of digitalis is to strengthen the contractions of the heart-muscle as well as to increase the contractions of the muscles of the blood-vessels. This would tend to make the heart beat stronger and somewhat faster ; but soon after the absorption of the drug the heart-regulating centre in the medulla is implicated, and as a result of the irritation in this centre the heart beats slower.

Under the full physiological action of digitalis the heart beats slowly (say 50 per minute), but stronger ; and the output of blood is increased, and the blood-tension raised throughout the body. This action, whereby all the organs of the body are better supplied with blood, may be continued for a long time under careful medical supervision, and digitalis is, therefore, one of the most reliable of all the heart-tonics. When given in large doses, or if accumulation of its effects takes place, the heart commences to beat more rapidly and irregularly, the blood-tension falls, and the patient appears to be seriously poisoned, with signs of cardiac distress and irregularity. This result often happens when the medication is prolonged, and it is usual to intermit when giving digitalis. The chief indications for its use are the various heart-disorders in which disturbance of compensation shows itself. The heart that is acting normally and is able to keep up compensation should not receive digitalis. Digitalis, moreover, is of practically little service where a quickly diffusable heart-tonic is required. It is often given also in kidney-diseases, but in these cases it is combined with other remedies in order to overcome its blood-raising effects. It is usually prepared either as an infusion given in half-teaspoonful doses or as a tincture in doses of five drops.

DIPHTHERIA.—One of the most dreaded of the diseases which affect children. It is due to the diphtheria bacillus discovered by Löffler, which attaches itself principally to the mucous membrane of the throat and nose, where it grows in enormous numbers. Its extremely toxic products are a source of danger to either child or adult. The most frequent site of the disease is the pharynx. It develops in from two to seven days after infection has taken place, and is ushered in by chills, fever, vomiting, malaise, loss of appetite, and headache, followed by hoarseness (croup), difficulty in swallowing, and pains in the throat. Greyish-white patches, tightly adherent to the underlying tissues, are found on the red and swollen tonsils, palatal arches, and uvula. These gradually extend to the surrounding areas, and may spread down into the larynx and bronchi. This condition is accompanied by a painful swelling of the neighbouring lymphatic glands in the neck. These appearances are developed in two to three days, and in the milder cases recede

within three to five days. In the more virulent types of the disease, the symptoms are all increased in severity and are accompanied by high fever and general exhaustion. The poison developed in the body by the bacteria may also bring about severe damage to the heart, the pericardium, the lungs, the kidneys, and the nervous system; and the disease may result fatally from interference with respiration, from pneumonia, cardiac weakness, or from paralysis. Even if this unfavourable course is avoided, the recovery of the patient may be complicated by various sequelæ which involve the heart, the lungs, or the kidneys. Or there may be paralyses of various kinds, affecting the muscles of the eyes, palate, larynx, chest, bladder, or rectum, including perhaps the entire arm or leg; or there may be long-continued hoarseness, loss of voice, disturbances of speech, squinting, etc.

FIG. 106. Method of holding patient in order to look into the throat.

The course of an attack of diphtheria varies with the age of the patient, the general condition of the system, and the severity of the epidemic. The mortality is greatest from infancy up to the fifth or sixth year, and then declines steadily until it is practically nothing in adult life. During the prevalence of an epidemic of diphtheria, parents must keep close watch over their children. Frequent examination of the throat may lead to an early recognition of the disease, in many cases before any other symptoms have appeared. Fig. 106 illustrates the most suitable manner of holding a child for the purpose of examining its throat. Any slight redness or swelling in the throat should serve as a warning, even before any membrane has appeared; and a physician should be called at once, in order that appropriate treatment may be instituted and further dissemination of the disease prevented.

If the diagnosis has been confirmed by the doctor, the patient must be isolated immediately, and the remaining children in the family kept under close supervision. It is advisable to send children with diphtheria to a special hospital if suitable quarantine cannot be maintained at home. All articles used by the patient, or with which he comes in contact, should be either boiled for half an hour or soaked in some germicidal solution. The

nurse should be dressed in gowns of washable material. Before leaving the sick-room, and also before every meal (none of which should be taken in the room where the patient lies), the hands must be thoroughly washed and disinfected, and the mouth washed out with some antiseptic gargle. At the termination of the disease, the rooms occupied by the sick person must be fumigated and then thoroughly aired. Convalescents also serve as a means for disseminating the disease, even for some time after their recovery, and this fact should always be borne in mind.

The method of treatment generally adopted at the present day, and which has been thoroughly tested by observations without number, is by the injection of the curative antitoxic serum discovered by Behring. This is entirely harmless in its action, and has triumphantly established itself in the confidence of the medical world in the face of great opposition. The earlier the patient can be given the benefit of this treatment, the more certain are its effects, and every moment of hesitation is unfavourable to the life of the patient. The brilliant results which have attended the procedure are shown by the statistics of the mortality, which has steadily declined from an average of 45 to 50 per cent. to 16 per cent. The curative effect of the serum is shown by the improvement in the general condition and strength of the patient, in the lowering of the temperature, the return of the appetite, and by the fact that the false membranes do not extend any further, but are thrown off. This favourable effect only follows the early administration of the antitoxin, before the poison from the bacilli has had an opportunity to do much harm to the system.

In addition to the constitutional treatment, cold applications may be made to the throat, ice may be swallowed in small pieces, and if much irritation is present relief may be obtained by gargling with cold, astringent solutions. Constriction of the pharynx or of the larynx, resulting from the swelling or from the exudations, sometimes leads to difficulty in breathing, or to choking, so that life is threatened ; in such cases the timely introduction of an intubation-tube into the larynx, or the operation of tracheotomy, may do much to revive the patient. The necessity for treating any subsequent paralysis of the various muscles must be determined by the physician, and should be left entirely to his discretion.

DIPSOMANIA.—Since Alcoholism.

DISINFECTION.—Since it is known that a large number of diseases are due to the entrance of toxic bacteria into the body, and that these are present on every object with which one comes in contact, efforts should be made to reduce the possibilities of contagion by limiting or destroying the offending germs. This may be accomplished by methods of disinfection, and for this purpose heat, in the form of fire, boiling water, or steam, and chemical substances which in weak solutions kill the bacteria, but which in stronger solutions are harmful to the tissues, are employed. Fire and boiling

water destroy bacteria very rapidly, usually within a few minutes. Live steam acts somewhat slower, although it kills even the most resistant forms in about half an hour. As a rule, articles to be disinfected are exposed to live steam for at least an hour.

Whatever comes in contact with a patient suffering from an infectious disease should be burned if of no value, and this applies especially to dressings soiled by purulent discharges. The linen for the bed and for personal use, as well as all metal objects, may be disinfected by boiling water. Live steam may be used for cleansing the wearing apparel. The commonly employed chemical disinfectants, which in dilute solutions may also be used in dressing wounds, are watery solutions of boric acid (5 to 10 per cent.), carbolic acid (1 to 5 per cent.), creoline (5 per cent.), lysol (5 to 10 per cent.), formaldehyde (1 per cent.), salicylic acid (1 to 3 per cent.), corrosive sublimate (½ to 1 per cent.), and also soap and chloride of lime. Objects exposed to the action of these solutions require varying periods of time for their disinfection, depending on the strength.

The choice of method must be governed by the character of the articles about to be sterilised. Linen which is to be boiled later may be soaked for twelve hours before removal from the sick-room in a 5 per cent. solution of cresol soap, or wrapped in cloths saturated in a solution of carbolic acid. Before throwing the dejecta into the toilet, they should be mixed with a solution of carbolic acid or with several spoonfuls of chloride of lime, and allowed to stand for twenty minutes. Vomited matter must be similarly treated. For disinfecting the water after a body bath, in a case of typhoid or other disease, four tablespoonfuls of chloride of lime are necessary. When this has been used, all metallic vessels must be thoroughly rinsed off with water ; otherwise they are liable to be attacked by the chlorine-gas. Any soiling of the toilet seat should be carefully cleansed with soft soap. Furs and leather goods cannot be disinfected with live steam ; they should be thoroughly aired, and may then be treated with one of the disinfecting solutions. Great importance attaches to the careful cleansing of the hands after having touched the patient or any objects with which he may have come in contact. They should be scrubbed with soap and plenty of warm water for at least five minutes, then rinsed, and finally immersed for from five to ten minutes in lysol or in a 1 per cent. sublimate solution. Especial care should be given to the cleansing of the nails. Rings must be removed and scrubbed, particularly on their inner surface. Personal infection may thus be avoided in many cases.

A very convenient mode of disinfecting the sick-chamber, together with the objects it contains, is by means of formaline vapour. This is done as follows. All openings, as windows, keyholes, cracks of the doors, etc., are carefully sealed with cotton rags, strips of gummed paper, or adhesive plaister. Draperies and similar articles are spread out so as to expose the

greatest amount of surface. The closets are opened, and the bed taken apart. The apparatus for evaporating the formaline, of which there are a number in the market, is then placed on a table in the centre of the room; a vessel filled with water should also be provided, with a spirit lamp underneath, so that the room may become saturated with the vapour. The door of the room is then carefully closed, and kept so for seven to ten hours. The vapours from the formaline and the water become thoroughly mixed in the closed apartment, and the bacteria on the contained objects are all killed off. At the expiration of the required time, all the windows of the room are opened, and left so from three to five hours, until all trace of the formaline vapour has disappeared.

DISLOCATION.—The displacement of one or more bones of a joint. When, following a rent in the capsule of the joint, the bony surfaces are so much protruded that they do not return into proper position of their own accord, the result is a dislocation. Dislocations should be treated only by a physician, who knows the normal position of the joints. It is necessary at times to administer a chloroform anæsthetic to effect a reduction. The sooner the reduction is undertaken the easier it is achieved. The layman should not meddle with these conditions. The only aid he can render is to place the dislocated limb in a position which gives the least pain.

The various quacks and natural bonesetters, so popular in certain localities, cause much harm, as they are often unable to recognise the exact nature of the injury. They have often mistaken and treated fractures for sprains, and dislocations for rheumatism, their treatment resulting in the partial or total inability of the patient to continue his livelihood. It is therefore wise to call in a competent physician in every case of injury.

DOMESTIC REMEDIES.—The following most prominent domestic remedies are arranged in different groups, according to their action:

Purges: Prune jam, one or two heaping teaspoonfuls; pure olive oil, one or two tablespoonfuls; castor-oil, a teaspoonful to a tablespoonful, according to the age of the patient. Children can be induced to take castor-oil by sprinkling the spoon with sugar; or it may be taken with a mild drink, such as sarsaparilla, or with coffee. The many household teas, so widely used as cathartics, are not safe remedies. They usually contain senna, which, used continuously, causes disastrous results.

Styptics: Cleansing of the wound with pure, cold water; pressing or tying of pure absorbent cotton to the bleeding place. Cobwebs are dangerous and unclean.

Stimulating Remedies: *Internally*: Acetic ether and Hoffmann's anodyne, 10 to 40 drops in water or on sugar every two to three hours; spirits of melissa and infusion of camomiles, one teaspoonful; strong, black coffee, a small cupful. Champagne cooled in ice, and soda-water with small pieces of ice, taken in spoonfuls, are useful in treating nausea and vomiting.

Externally: Vinegar; French brandy; Cologne water; smelling-salts; and spirits of sal ammoniac.

Emetics: Irritation of the pharynx with the finger or with a feather; drinking large quantities of lukewarm water, soap water, or mustard and water. Emetics which act speedily and vigorously, such as tartar emetic, bluestone, etc., should be prescribed only by a physician.

Remedies for Diarrhœa: Dry Claret (Bordeaux or Dalmatian); thin, strained decoctions of rice, barley, or oats, in tablespoonfuls. *Clysters* of starch gruel (one tablespoonful of starch, mixed with a little water, and then boiled with about half a pint of water under continued stirring). Warm poultices upon the abdomen. A cathartic, such as castor-oil, is advisable in the beginning in practically all cases of diarrhœa.

Remedies to disguise Taste: Bitter powders are enclosed in wafers, or taken with jam, with fresh fruits (in a cherry or prune), in the foam of beer or in a sip of wine, soup, coffee, lemonade, raspberry syrup, soda-water, peppermint tea, etc. Bitter liquid medicines may likewise be taken mixed with these fluids. A bad after-taste (as of cod-liver oil or of castor-oil) is sometimes removed by the chewing of a crumb of bread, a roasted coffee-bean, a piece of chocolate, or a peppermint lozenge.

Cough Remedies: Warm, semi-liquid fluids in small quantities; marshmallow tea, one teaspoonful to a cup of hot water, after infusing for about one-half to one hour; malt extract, in teaspoonful doses; lime drops; marshmallow drops; sal ammoniac pastilles, to be taken only if the irritation to cough is very marked. *Externally*: Cold compresses (which become warm) upon the throat and chest; inhalation of steam. Warning should be given against wasting valuable time by using these cough remedies. A physician should always be summoned at the earliest possible moment, as COUGHS (which see) may often mask a serious disease.

Plaisters: Court-plaister (to be moistened with water, not with saliva), used solely to cover very small cut wounds or superficial abrasions. Sticking-plaister is now usually bought ready for use, as the ordinary yellow sticking-plaister, or a very adhesive white caoutchouc plaister. Oxide of zinc plaister is also useful. It is unnecessary to warm the sticking-plaister over a flame; pressing it slightly to the skin is sufficient to make it adhere. Cut in strips of one-half to one inch wide, it is used to fasten bandages, or to cover wounds and abrasions previously cleansed and dried, or as a protective covering for hard skin and callosities. If the plaister is left in place for several days, or if its use is continuously repeated for some length of time, the skin is very liable to become reddened and inflamed. A physician should be consulted as to whether the use of a plaister is permissible, and also as to whether plaisters with medicinal ingredients may be employed. Salicylic acid plaister (so-called tourist's plaister; corn-plaister) often causes a violent inflammation of the skin. Red-lead plaister, which contains

PLATE VII.—ARTERIES OF THE NECK AND HEAD

1. Masseter muscle
2. Facial artery
3. Common carotid artery
4. Sternoclidomastoid
5. Left subclavian artery
6. Clavicle
7. Occipital artery
8. Superficial temporal artery
9. Internal carotid artery
10. External carotid artery
11. Trapezius muscle


1
2
3
4
5
6
7
8
9
10
11

camphor, is sold as a cure-all plaister by many druggists and quacks ; it is no more harmful than ordinary sticking-plaister, but it is not any more efficacious either, and surely not in any internal disease.

Blistering-Plaisters redden and inflame the skin. If they are left in place for any length of time, they cause the formation of blisters ; sometimes even of ulcers. Irritation and reddening should be the only result sought for, as a rule. It is advisable to remove them as soon as pain becomes noticeable. To allay the discomfort, cold compresses should be employed.

Mustard-Poultice is made by mixing one to three tablespoonfuls of mustard powder and an equal quantity of flour with sufficient lukewarm (not hot) water to make a thick pulp. This is wrapped into old, fine linen, and placed upon the skin. For small children two or three times as much flour or linseed meal may be admixed. The mustard-poultice should remain in place for about five to ten minutes. When a mustard-poultice is placed upon the soles of the feet, upon the calves of the legs, or upon the neck of unconscious persons, great care must be taken that it should not remain too long.

Mustard-Paper is unsized paper, one side of which is pasted with mustard powder. The paper surface is immersed in lukewarm water, and immediately put in place. Dry mustard powder enclosed in mull may also be placed upon the skin ; the fresh or soaked dry bark of mezereon or freshly grated horseradish may likewise be employed as blistering-plaisters.

Salves : These are medicinal mixtures of slightly greater consistency than lard. Simple salves which may be used to allay pains when the skin is not injured are : boric acid ointment, cold-cream, rose ointment, glycerine ointment, spermaceti ointment, and salves of lead, zinc, and paraffin. Vaseline, lanoline, and ointments of boric acid, lead, or zinc, spread upon linen, may also be used to cover wounds. Of ointments which irritate the skin to a slightly greater extent, and which possess a markedly aromatic odour, may be mentioned rosemary, juniper, and turpentine salves. Blue ointment, as well as the ointments usually applied for lice, the itch, etc., should be used only according to a physician's directions, as with insufficient care they may give rise to extensive inflammations of the skin, and even to general poisoning. Rubbing too briskly may also injure the skin. The rubbing should be done with the palm of the hand in circular movements and with slight pressure.

Sudorifics : These are medicines or other agents that produce sweating. Perspiration is often very beneficial in slight affections due to cold, such as nasal catarrh, violent pains in the limbs, or lumbago ; but it must not be exaggerated and continued for several nights. To produce perspiration it is often sufficient, in those who are not accustomed to it, to cover them with a feather bed. The effect is assisted by the drinking of various hot drinks, such as hot lemonade, weak tea with lemon-juice, or infusions of

elder-flowers, camomiles, peppermint, or melissa. These teas are prepared like ordinary tea, and one or two cups are taken (with sugar) before retiring.

DOVER'S POWDER (PULVIS IPECACUANHÆ ET OPII).—A compound powder consisting of ten parts of ipecac, ten parts of opium, and eighty parts of potassium sulphate. It is used as a pain-allaying remedy in many non-febrile affections. In dysentery and diarrhœa its action is often very grateful. The dose is from 5 to 15 grains. A warm drink taken after the dose insures more rapid action.

DREAM.—Our mental activities are not suspended during sleep, and the connection between sleeping consciousness and waking consciousness is not entirely interrupted. We usually dream of things that we have busied ourselves with while awake, and our sense perceptions go on to a certain degree. Two characteristics, however, differentiate dreaming states from wakeful states: in the first place, the fantastic transformation of the sense impressions; and, secondly, the confusion of the course of thought. Free, easy breathing creates in the dreamer an impression of flying; heavy breathing creates a feeling of fear; splashing rain becomes a flood; a fly bite a dagger thrust; a hot-water bottle, a promenade in the tropics; the buzzing of a fly, a hurricane; a gleam of light, paradise and all its angels; the uncovering of part of the body, a sleigh ride; etc. The confusion of the course of thought causes the abrupt changes of the dream visions. The picture changes without interruption and without causing any surprise. This incoherency in the train of thought, and the lack of judgment it carries with it, refers also to ideas of time. Dreams which last only a few seconds or minutes may appear to last an eternity.

Whether deep sleep is dreamless, as is claimed, seems doubtful, even improbable. The dreams of light sleep are generally more senseless and disjointed than those of deeper sleep, in which entire dramatic scenes may be reproduced. Movements of the muscles are not a rarity in dreaming states. Generally they are the muscles of speech and of the face (speaking, laughing, and crying during sleep); but at times other muscle groups become active, and in such cases the dreamer will get out of bed, walk about, and perform customary tasks. After awakening, there is no remembrance of what has gone before. These cases are instances of somnambulism. Many stories are told about these somnambulists. The most wonderful feats are ascribed to them; for instance, walking along the ridge of the roof of a house. Most of these stories are fictitious, but it cannot be entirely gainsaid that somnambulists at times evince remarkable dexterity. This is explained by the fact that the dreamer's consciousness is limited, and that his attention is directed to such an extent to a given undertaking that the thought of a dangerous position, which would at once arise in the wakeful mind, falls aside. Somnambulism is also called moon-sickness; but the moon has very little to do with the condition, excepting that its rays

of light, entering the sleeper's room may cause dream impressions in him. Any other light—for instance, a lamp light—has the same effect.

The interpretation of dreams has always played an important rôle in the history of mankind; particularly the interpretation of such dreams as presage sickness or death. Superstition has had full sway in this domain, but there is nevertheless some truth in the popular notion. Sometimes certain physical disturbances are felt while dreaming which have not been noticed while awake. For instance, a hitherto unnoticed disturbance of circulation in the leg may appear in a dream to be an inflammation, this latter condition actually occurring a few days later. However, it is wise to be cautious about such prophecies; and even more so regarding dreams premonitory of coming misfortune, etc. Chance and a fallacious memory may be important factors.

DRESS.—The principal object of dress is to provide the body with a necessary amount of heat. Although this object of dress has ever been the most essential and the original one, it is scarcely possible at the present time to separate the question of utility from that of adornment; and it is only too often the case that usefulness is made subservient to the dictates of fashion. Changes of the weather, especially those of temperature, compel us to direct our attention to a rational mode of dressing, thus to assist the heat-regulating activity of the skin. With respect to this it is true that great differences exist in different individuals. Some people, for instance, may feel comfortable in clothes which others could not wear without danger of catching cold. The elementary materials of our dress are derived from the animal kingdom (wool, silk) or from the vegetable kingdom (linen, cotton). These can be distinguished readily by the eye alone. The simplest method to distinguish between wool and silk on one hand, and linen and cotton on the other, is by the test of burning. Wool and silk, when ignited, smell like burnt horn; linen and cotton more like burnt paper. With the aid of a microscope and of certain chemical expedients, it is easy to distinguish the chief textile fabrics.

The most important object of dress from a hygienic standpoint is to regulate the amount of heat that is given off from the skin. Clothing limits the amount of heat lost in cool surroundings, and allows the ready passage of the heat which is constantly formed in the body. But the human body not only gives up heat to the surrounding air, but water, in the form of invisible vapour, as well. The amount of aqueous vapour given off varies with the temperature, the muscular activity, and the amount of humidity of the atmosphere. If large quantities of water are given off, it appears, not in the form of vapour, but in drops, as perspiration. The clothing should not offer any resistance to this giving off of water; and for this reason it should be porous, so as to allow the passage of air. Undoubtedly great differences are to be noted in the heat-retaining properties of the various fabrics.

Experience teaches that a woollen shawl retains the body heat better than a cotton or linen one. The property of being able to retain the body heat is not due to the substance of the fabric, but is rather a property of its mode of weaving. A right proportion between the amount of substance and the size of the mesh determines the quality with reference to the retaining of heat and moisture. A second factor is found in the thickness of the fabric. In keeping with their lesser air content, the smoothly woven fabrics retain the heat the least; loosely woven materials more, and flannel fabrics the best. There is a very large amount of air space (about $\frac{9}{10}$ of the whole) in flannel fabrics.

Although it follows that the heat-retaining quality of the various fabrics is determined especially by the nature of the weave rather than of the substance, there are certain qualities which do not render them equally suitable to be manufactured into textures. Wool can be woven into the loosest textures, whereas vegetable fibres are less well adapted for this purpose. If the conditions of looseness and of thickness are of especial importance when it is a question of protection from loss of heat in cold surroundings, the porosity of the fabric is of particular moment in hot temperatures. Probably everyone has experienced the oppressing sensation of being overheated during the hot summer months when the air is very moist. How does this sensation arise? The body rids itself of its own heat by conduction, by radiation, and by the evaporation of water. The loss of heat by the evaporation of perspiration is especially important. Restriction of this function leads to an overheating of the body; sometimes even to an accumulation of heat with dangerous consequences. See Heat-Stroke. The evaporation of water from the skin is retarded especially when, in addition to the customary outer garments, closely woven fabrics such as smooth linen or cotton textures are worn as undergarments. As already mentioned, these contain a comparatively small amount of air; hence, they do not retain heat. This of itself would be an advantage during the hot weather. But this advantage is more than outweighed by their inferior porosity, since such textures offer considerable resistance to the evaporation of water from the skin. This causes a ready formation of perspiration, which soon clogs up the few air-pores of the garment and completely hinders further evaporation.

But this is not all. The linen or cotton texture, fully saturated with the water of perspiration, no longer contains any air; hence, it does not retain heat at all. This condition does not cause any inconvenience so long as the individual remains in a heated atmosphere, but he will feel the annoyance thereof the moment he passes into a cooler place. Experience has taught the necessity for being cautious when cooling off after strong perspiration. Anyone dressed in garments of loose texture will in such an instance run much less risk of catching a cold than a person who wears clothes of

smooth texture. The latter, rendered airless by the accumulation of sweat, act in an extremely cooling and refrigerating manner. The fabric of loose texture may also absorb sweat, but this soon evaporates through the pores of the garment, and it is only in the rarest cases that all the pores become filled with water. Sufficient air will almost invariably be retained to protect the skin from too sudden loss of heat, and, therefore, from excessive exposure.

The following general principles regarding a rational mode of dressing can be deduced from the above statements. The essential point is the correct selection of undergarments. These should be made of a loosely woven fabric, which should be selected heavier in winter, lighter in summer. Smooth, closely woven linen and cotton fabrics are not suitable ; the starched bosom shirts used by men are especially out of place, as the starching renders them absolutely unporous. It is not sufficient, however, to secure loose, porous underclothing, as the favourable effects provided by it can be counterbalanced by closely woven, unporous outer garments. The smooth, thin, woollen fabrics which are preferably worn as outer garments in summer are harmless in this respect, as they are still sufficiently porous ; the same applies to the more loosely constructed winter fabrics. But the material used for linings is generally quite unfavourable for ventilation, and its removal or displacement by other, more porous material would be desirable. With changeable temperatures, a sensibly dressed person regulates his requirement of heat and cold by a corresponding change in his outer garments, wearing the same underclothing. With regard to undergarments the question remains to be decided whether loosely woven woollen, cotton, or linen fabrics should be preferred. As is well known, everyone of these materials has had its advocate in its time. Jäger extolled woollen garments as the only correct ones ; Lahmann defended cotton ; and Pastor Kneipp favoured linen fabrics. The discussion already outlined shows that a so-called " normal dress," suitable for all conditions, and based upon a certain elementary substance, does not exist. The only rational dress is one which is adapted to the changing external and bodily conditions. However, it cannot be denied that wool possesses certain advantages over the other elementary substances. The fine little fibres of wool act as supporting hairs, creating a kind of insulating layer of air between the skin and the undergarment. Some persons, however, cannot wear wool next to the body because their skin is very sensitive. Wool absorbs water only incompletely, and therefore remains drier ; it absorbs the secretions of the skin well, and it is lighter than garments made of vegetable fibres. Other mystic qualities, such as are ascribed to it by Jäger, wool does not possess. On the other hand, these superiorities of woollen garments are counterbalanced by certain disadvantages. Woollen fabrics are soon worn out, and they soon become dirty. To combine the favourable properties

of animal and vegetable fibres, mixed fabrics are now manufactured which are well adapted for porous underclothing.

The question of cleanliness is one which is apt to clash with the principles here described, and it is probable that for this reason smooth, closely woven linen and cotton fabrics can never be discarded entirely. These materials are suitable, above all, for outer garments ; primarily in surroundings where protection from dust is desired. For use in the summer, as well as in the household and for nursing, white, smooth cotton garments, worn over porous underclothing, are hygienic and clean. As darker materials absorb more heat from the sun's rays than lighter ones, the colour of the clothes also plays a small part ; and for this reason alone white linen and cotton outer garments must not be underrated.

In addition to these more general considerations, some special questions of dress need discussion. With regard to the cut of the outer clothes this is well known to be subject to fashion. From the hygienic standpoint, fashion is harmless as long as it does not lead to an unnatural or unsanitary compression or uncovering of certain parts of the body. Generally speaking comfortably fitting garments are naturally preferable. For certain purposes it appears serviceable and practical to make the clothes waterproof ; but garments that are made completely waterproof by a covering of caoutchouc or varnish are by the same process rendered absolutely unporous, and are not beneficial to health for reasons already stated. Such garments should, therefore, be used temporarily only. A fair protection against drenching is, however, afforded by clothes impregnated with certain other substances, which partly preserve the porosity of the material.

Another question is whether the numerous dyestuffs used in fabrics may all be considered harmless. By far the majority of them may be used without detriment to health. Some of the injurious ones, as those containing arsenic, are forbidden by law in certain communities ; others, containing chrome, antimony, or aniline, are not very likely to cause poisoning from the skin, and do not, therefore, deserve much attention. Occasionally, poisoning has occurred in the skin of the feet from new stockings.

The usual head covering is generally rather too warm than too cool, at least that which is used by men. In so far as it is a question of combining porosity with waterproof qualities, the establishment of at least a moderate ventilation by air-holes should be taken into consideration. Fur caps should be worn only in very cold weather. In summer, as is well known, a light covering for the head is most desirable. Light straw hats perforated on the sides, or light white caps with air-holes on the sides, answer the purpose. In a scorching sun, the back of the head and the nape of the neck should be protected. To guard the eyes from the dazzling rays of the sun, it is of advantage to wear wide-brimmed hats, or caps that are shaded in front.

Garments that constrict the neck should be avoided, as they may impair the normal circulation of the blood to the head. The dictates of fashion unfortunately often favour tight-fitting collars for women's apparel; and certain excessively high collars worn by men are not much better. The free exposure of the throat and of the upper part of the chest may become quite as harmful.

Experience teaches that it is of great importance to keep the abdomen warm. Offences against this rule are often accentuated by disturbances of the digestive organs. Here, too, the susceptibility of different persons varies considerably, and for some people it may be advisable to wear an abdominal bandage during the cooler seasons. In temperate climates the limbs, no less than the other parts of the body, require the protection of garments. In a certain respect they require it still more, as they are situated at greater distances from the heart, and may occasionally suffer from a diminished blood supply. This is not the case so long as the limbs are vigorously exercised; but if the mode of living is such that the body is often at rest, the circulation of the blood sometimes becomes impaired, and the heating of the extremities insufficient. While an incomplete covering of the arms and legs is not often encountered in adults, it is frequently customary to allow children to be about with naked arms and with partly uncovered legs. In cold weather this is not advisable.

The use of gloves appears to be appropriate only under certain conditions; especially during the cold season to prevent affections of the hands or of the tips of the fingers by frost-bites. It is well known, however, that in a great number of cases the winter-glove accomplishes the opposite of that for which it is intended, and by constriction of the blood supply more than favours the numbing of the fingers. In order to be actually warming, gloves must be very wide, and should preferably be mittens. The thicker the gloves are, and the more airy and loosely woven their texture, the warmer they will keep the hands.

Whereas the hands are kept covered only exceptionally, the constant covering of the feet during the day is customary. The clothing of the feet is intended for a twofold purpose. It should prevent the pronounced loss of warmth which arises when the foot touches the cold earth; and it should protect the foot from injuries, wet, and dirt, and impart to it a certain firmness. Stockings protect the feet against overheating, and form a kind of yielding bolster during walking. As shoes and stockings together are only slightly porous, diminution of evaporation occurs, and in consequence there is usually excessive sweating. In cases of insufficient cleanliness the latter, together with the cast-off particles of the skin, decomposes, and gives rise to the notorious disagreeable odour of perspiring feet. This abnormal sweat formation occurs to a very annoying degree in some persons who appear to be predisposed in this direction. This affection can best be

prevented by scrupulous cleanliness (daily foot-baths) and by the wearing of porous, absorbent stockings. At the same time it is advisable to wear perforated shoes or sandals whenever possible; for instance, at home. More marked sweating of the feet requires treatment by a physician. Rubber shoes, which still more restrict the evaporation of the covered foot, should be worn only temporarily, and should always be taken off as soon as possible.

As to the form of the shoes, it is a well-known fact that for the most part they do not correspond to the shape of the feet, therefore they press the latter into constrained positions which may lead to deformities (dis-

FIG. 107. Deformity of foot due to badly-fitting shoe.

placement of the big toe toward the side of the small toe; see Fig. 107) and to a number of troublesome conditions (corns, ingrowing nails, etc.). The sole is shaped correctly only when a line which passes through the middle of the big toe, running parallel with the latter, strikes the middle of the heel. The uppers also must be worked highest in the course of this line, and the forepart of the shoe must adapt itself to the form of the toes. However, as most "hygienically constructed" shoes present a very clumsy appearance, there is very little prospect of their becoming generally adopted. The problem of making hygienic shoes of becoming appearance has, however, been fairly well solved by the shoemaker. Laced shoes are preferable to those with elastic sides, as the latter may impair the circulation of the blood. The heels should not be too high.

If the male dress is not fully in keeping with the requirements of hygiene, this, as is well known, is still much more the case with the female dress. That part of the female dress which has ever given rise to criticism on the part of the medical profession is the corset. It is claimed that Queen Elizabeth invented it to cover the deficiencies of her figure. In other respects, the principal effect of the corset is obviously to cause the female sexual characteristics to become more conspicuous. The history of the corset is a

classical example showing what fashion is able to do, and how unrelentingly it can enslave its followers, especially the female sex. It is very remarkable that to a great number of women the most conspicuous and most variegated costumes are not obnoxious, whereas another pattern of dress, which is not in style but more sanitary, is detested by them as disagreeably ostentatious. And finally, the excuse is always given : " What has done no harm to our mothers, will not prove injurious to us either ; hence, let us continue the old habits." This view can be explained only by the fact that but a very small number of women have even the slightest idea of anatomical conditions, and are in no way aware how they injure the organs of their body. As custom renders everything bearable, it is probable that the originally annoying pressure of the corset is no longer, or only occasionally, felt.

Tight lacing exerts a manifold, harmful influence upon the female body. The lower part of the bony thorax is compressed (see Fig. 33) ; and the muscles of the back and of the belly are squeezed and thereby weakened. The internal organs naturally also give way to the pressure, and try to find another place. The liver, stomach, and intestines are pressed downward ; the activity of the diaphragm, so important to respiration, is restricted ; and the lower parts of the lungs are prevented from proper expansion. This general constriction causes, further, an impairment of the large blood-vessels which maintain the circulation between the upper and lower halves of the body. In short, not only the most vital function, that of respiration, is disturbed, but also the circulation of the blood and the digestive functions are interfered with. In addition, the forcing downward of the intestine is very liable to cause displacements, inflections, and dragging of the internal female genital organs. A host of affections of girls and women owe their existence directly or indirectly to tight lacing.

Especially marked, and conspicuous even to the eye of the layman, is the influence of tight lacing upon the liver. As every physician has had opportunities to observe at autopsies, the liver of a female corpse often shows an indentation in the region of the waist (tight-lace liver). Still more, tight-lacing may even give rise to almost complete separation of some of the lower portions of the liver. It is obvious also that the gall-bladder, which is situated behind the lower border of the liver, frequently suffers by pressure, which favours the formation of gall-stones. Since it is certain that there is often a causal connection between gall-stones and the development of cancerous tumours of the liver, and since the latter diseases occur relatively much oftener in women than in men, it is undoubtedly permissible in many cases to ascribe the fault to the corset.

Similar symptoms as those produced by tight lacing may occur also if the bands of the skirt are drawn too tight (see Fig. 108). In general, women carry the weight of their dresses on the wrong parts of the body. The

principal weight of the dress should be borne by the shoulders, not by the hips. In most women the covering of the lower half of the body is much too heavy, owing to the customary numerous petticoats.

But how is the corset to be replaced? A substitute for the corset must not in any way press upon any organ of the body. On the other hand, it must give sufficient support to the breasts, and be suitable to hold the other

FIG. 108. Constriction due to tight waistband.

undergarments. For these reasons, shoulder-bands are indispensable. The number of advertised corset substitutes is a very large one, and we cannot here enter upon details.

The reform of female undergarments is a question which is closely connected with this corset reform. It has been said that the weight of the former is usually excessive, and that their fastening by binding is not practical. They should, rather, be fastened by buttoning them to the bust-holder But, to do this, the undergarments require to be simplified. In place of the petticoats closed bloomers have been recommended, if necessary with drawers that can be buttoned into the same; and in place of undershirt and drawers, the so-called combination-suits (see Fig. 109).

All these innovations would diminish the weight of the dress without impairing its warming effect. Closed drawers possess obvious advantages over the undergarments formerly in use, especially with reference to keeping warm. Stockings should not be fastened by round garters over the calves, but should be attached by aid of hose supporters to the corset substitute; otherwise, in consequence of constriction of the blood-vessels, the garters are apt to cause congestion of blood in the legs (varicose veins).

In a rational dress for women, at least the street dress should not reach down further than to the shoe tops. Apart from the comfort of the wearer, sanitary view-points are determining in this respect. Trailing skirts whirl up the dust, which is generally looked upon as something injurious to health, as it is conducive to a dissemination of disease-germs (especially tuberculosis) which may enter the respiratory organs. A lively agitation against allowing the wearing of trailing skirts in the streets has therefore become manifest in many places; and it has been suggested to abolish the nuisance by local bye-laws. Conceive the amount of filth brought into the house by the edge of the skirt of a fashionable lady! Ought not the sense of cleanliness alone—quite apart from all hygienic considerations—to object to this nuisance?

FIG. 109. Practical combination-suit.

FIG. 110. Ideal mode of dress.

These are the principal points in which women sin with regard to their dress. Two others, less important ones, may be briefly mentioned. While nowhere else the outer garments (which as a rule are not washable) are worn near the bare skin, the blouse is worn day after day over the bare arms and neck, and the upper part of the breast. The necessary

consequence is that it gradually becomes greatly soiled in these places. Further, the wearing of a veil is a superfluous fashion which is harmful to the complexion. That the skin of the face becomes rough and abnormally red (especially the point of the nose) is, not wrongly, ascribed to this fashion. Neither is the veil without harm to the eyes. . See EYE, CARE OF.

To combat fashion with logic is generally a vain undertaking. It would, besides, be quite unjustifiable to ask women to surrender many of their little decorative means simply because they are not quite appropriate. But the gross transgressions of fashion against health should be combated by every one. That this struggle need not always be carried on at the expense of what is beautiful and pleasant—assuming earnest intentions and endeavours—is probably certain ; and, finally, the conception

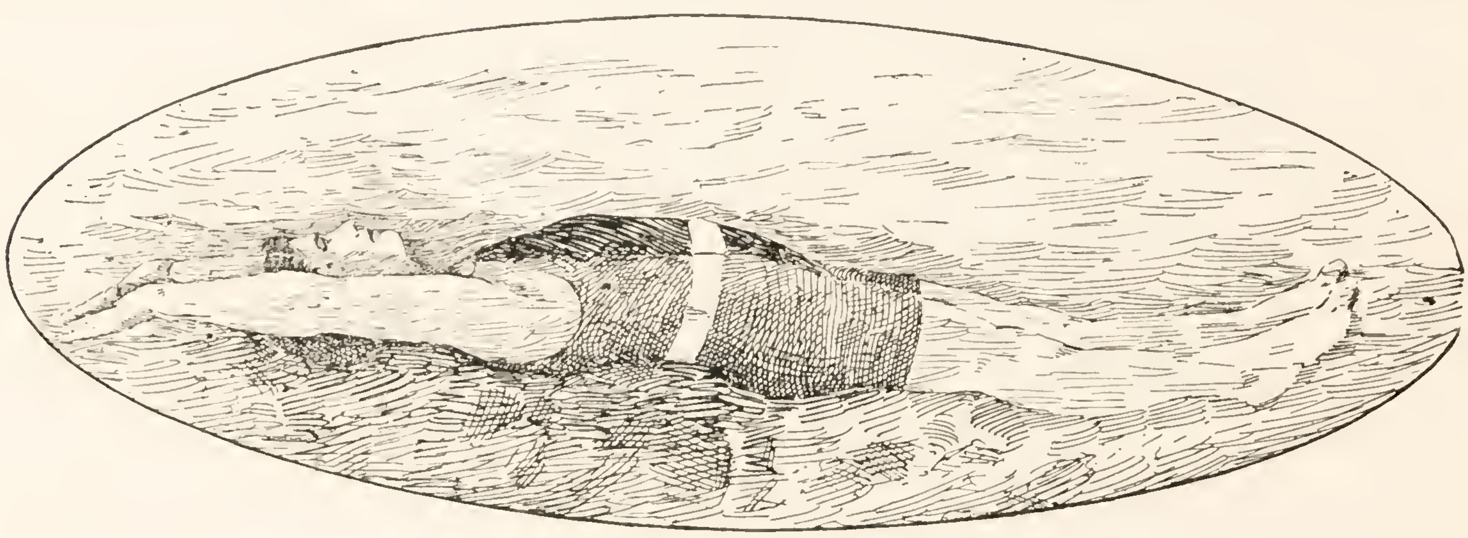


FIG. 111. Correct attitude in floating.

of what is beautiful and pleasant in the dress of woman is exceedingly changeable. It is certain that many fashions which at first impressed us as the strangest, appeared not only bearable, but often even becoming, after a short time of habituation.

DROPSY.—A condition in which the fluid portion of the blood escapes from the blood-vessels and collects in the body-cavities or under the skin. It may appear in the course of many diseases, owing perhaps to a sluggish condition of the blood caused by impairment of the propulsive power of the heart or by other disturbances, or owing to the fact that the walls of the blood-vessels have become permeable on account of faulty nutrition. In such cases the serous fluid exudes in large quantities and collects in various parts of the body. According to the part of the body affected, this causes dropsy of the brain (see HYDROCEPHALUS), of the skin, of the chest (see CHEST, DROPSY OF), of the pericardium (see HYDROPERICARDIUM), or of the abdomen (see ASCITES). Dropsy is therefore not a specific disease, but always a symptom of another disease ; and consequently the treatment always depends upon the original disease, upon the nature of which depends in turn the possibility of permanent or temporary alleviation of the œdema.

The laity is in great dread of this "water." But as in many cases these dropsical swellings can be cured with proper treatment, there is no need to

be uneasy about them, or to arouse a feeling of anxiety in the patient's mind.

DROWNING.—Anyone in danger of drowning should at once turn on his back, bend his head backward, and extend his arms on the water, not above it. He should keep his lungs filled with air by making deep inspirations and short expirations. The attitude in which he will best keep himself floating is shown in Fig. 111; whereas the raising of the arms (see Fig. 112) should be avoided, as it causes the head to sink below the surface. A rescuer who is unable to swim should hold out some object (as an oar or a pole), or throw a life-preserver or a rope to the drowning; if none of these objects is at hand, he should try to reach the unfortunate by the aid of a coat-sleeve, or by a rope formed by tying together other parts of his dress. If the rescuer is a swimmer, he should grasp the drowning person by the hair, turn him on his back, and swim toward the shore holding the body with both his hands, he himself swimming on his back.

FIG. 112. Incorrect position in water.

If someone has broken through the ice, and is unable to help himself because the edge of the ice is continually breaking, a ladder, a long pole, or a board should be pushed toward him (see Fig. 113). If the distance is too great, two ladders may be used by being pushed alternately forward

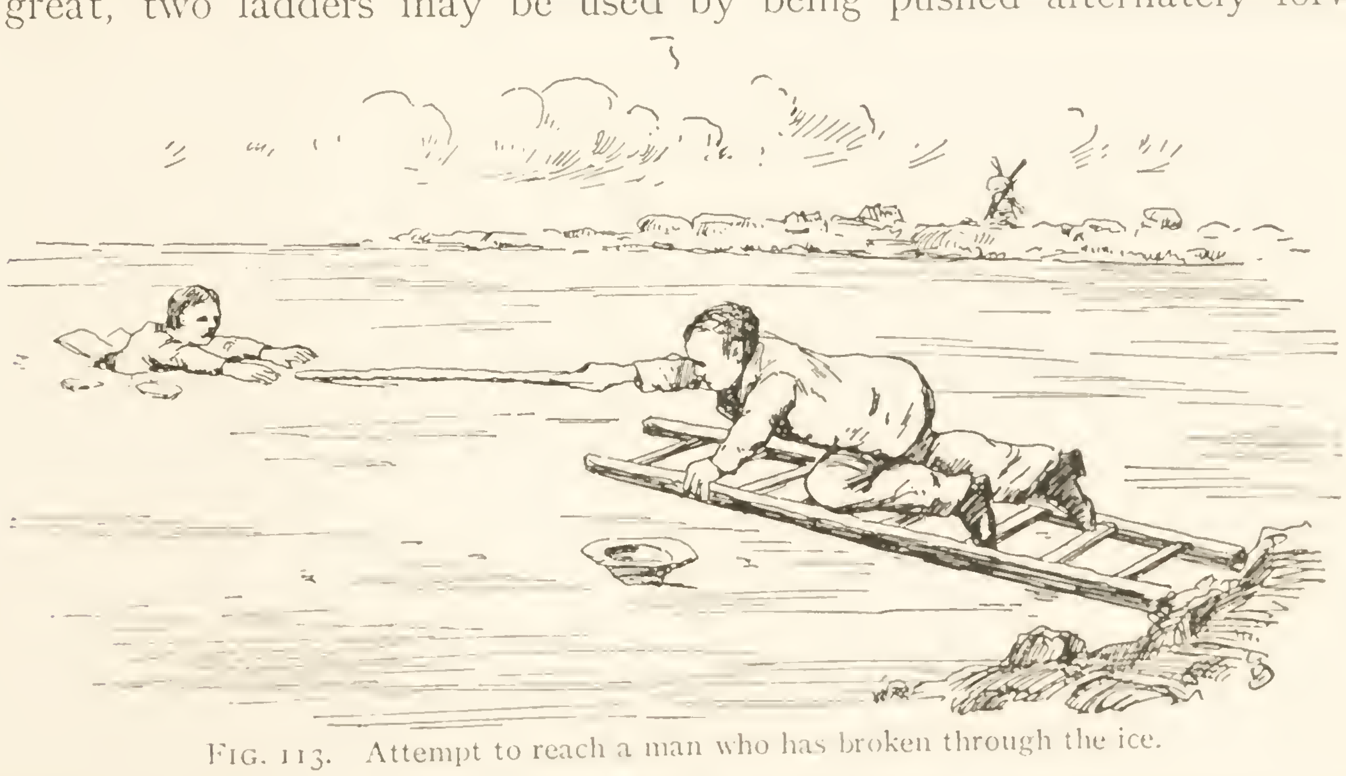


FIG. 113. Attempt to reach a man who has broken through the ice.

(see Fig. 114). In the absence of these expedients, it is advisable to crawl toward the drowning as soon as the weak portion of the ice is approached,

or at least to place a long stick or an oar across the back, holding it with both arms. In case of breaking through the ice, this stick will prevent drowning (see Fig. 115).

A person in danger of death by drowning has either a bloated, bluish-red appearance, with bluish lips, bloodshot eyes, and slime in his mouth,

FIG. 114. Use of two ladders in attempt to rescue a person who has broken through the ice.

or he is pale and in a deep faint. Even when a drowned person has been under water for some time, it may be possible to resuscitate him if the attempts are continued for hours. In the first place, his mouth should be opened wide by pressing down the lower jaw; and dirt, sand, and water

FIG. 115. Method of holding stick for self-protection.

should be removed by introducing the finger deep into the throat. At the same time vomiting should be induced by tickling the pharynx. The body is placed upon the belly, and a roll prepared from clothes is pushed under the pit of the stomach. This is at once to be followed by ARTIFICIAL RESPIRATION (which see).

DRUNKENNESS.—See ALCOHOLISM.

DULCAMARA.—The bittersweet, or woody nightshade (*Solanum dulcamara*), a trailing plant distributed throughout Great Britain. The parts used in medicine are the dried, young branches of the plant, which has a bright purple, potato-like flower, with scarlet fruit, often called the poison-berry. The active principles of the plant are glycosides, and it has some of the poisonous qualities of belladonna and of other members of the nightshade family (*Solanaceæ*), notably of *solanine*, the action of which is sometimes present in sprouting potatoes. Poisoning by this drug causes nausea and vomiting, intense prostration, and some signs of destruction of the blood.

DUMBNESS.—See SPEECH DISTURBANCES.

DUST DISEASES.—Inflammatory diseases caused by the inhalation of large quantities of dust. Persons who are engaged in certain callings in which they are continuously surrounded by an atmosphere of dust are especially liable to contract such diseases. If there is no increased inhalation of dust, it is generally thrown off again. Some of the dust particles remain on the moist mucous membranes of the nose, of the pharynx, and of the throat; others are caught up and deposited on the protruding surfaces of the turbinated bones, or on the ever-present deviations and deflections of the septum, and are finally deposited in the pharynx, which turns downward almost at right angles with the nose (see Fig. 47). When dust reaches the bronchial subdivisions through the glottis, the small ciliated cells which rest in rows on the mucous membrane of these parts are able to throw out the dust particles by aid of their small hairs, which move outward in the direction of the mouth. In the construction of the respiratory passages there lies a natural protection against the inhaling of dust. The inhaling of quantities of dust, especially if heavy and injurious, causes the respiratory organs to lose this natural means of protection, and inflammation sets in, which often extends from the nose into the lungs. A constant catarrh of the nose, throat, larynx, and bronchial tubes is characteristic of persons who work in dusty places.

The typical "dust lung" is of rare occurrence. In such a lung the spongy tissue is gradually transformed by the foreign bodies into a firm, cicatricial mass. Occasionally these parts, thus cut off from the circulation, die off and soften. If this process involves the bronchus, the softened mass is coughed up and a lung cavity results. If a blood-vessel is involved, there follows a hæmorrhage of the lungs. Thus, in consequence of the effects of dust, changes resembling consumption may take place in the lungs, with the exception that there are no tubercle-bacilli in the sputum. Experience shows, however, that in these conditions of the lung such bacilli are easily deposited, and settle on the lung. It is a fact that persons doing dusty work are more often afflicted with consumption than any other class of people.

The first aim of factory hygiene should be directed toward overcoming the diseases caused by the inhalation of dust. No industry claims more victims, and causes more injury to health, than one in which the workers are exposed to the inhaling of dust. It must be admitted that this is not an easy task ; yet the provisions made by the State and by the manufacturers in this regard are by no means perfected. Special endeavours should be made to provide large, airy workrooms, which must not be overcrowded ; to have the raw materials moistened ; to have work which creates dust performed in closed compartments ; to dismantle dusty places, removing the dust ; and finally, as a last resource, in cases where the removal or suction of dust is impossible, to make use of respirators (Fig. 116), damp sponges, and the like, which are tied to the nose and mouth, excluding dust mechanically.

FIG. 116. Device for protection against inhalation of dust.

If health becomes impaired from doing dusty work, an early change of occupation should be made ; a later change is often impossible, if for no other reason than that of economy.

DWELLING-PLACES.—Man's comfort, his happiness, and the health of his family depend to a great extent upon the character of his dwelling-place. A dark, narrow, dirty, and noisy house is not conductive to contentment, and is often the reason why a man instead of finding his centre of attraction in his home and family, seeks it ouside of the home—in the drinking-house, or in a place of amusement. The living-place is, therefore, one of the things in life which is most unsuited for the practice of false economy.

When choosing a dwelling-place, the following points should be borne in mind ; An elevated portion of the city is to be preferred, on account of being drier and airier. The upper storeys of a house are generally lighter, and more airy and quiet than the lower ones. The dwelling-place ought not to be too far distant from the place of employment, nor from the school, unless it is in easy and inexpensive connection with these by railway or other means of transit. The vicinity of badly-smelling or noisy factories should be avoided if possible. Regarding the light exposure, see the article on LIGHT. It is possible to take all these things into consideration, even in cases where the pecuniary aspect is an important factor.

The dwelling-place should have a well-lighted entrance, but not a steep

one. Houses with dark stairs cannot be kept clean, and, the atmosphere not being pure, such houses are hurtful to live in. The number of available rooms must depend upon the individual means. The sleeping-rooms must be chosen with special care, not so much so the living-rooms or the working-rooms. Too much stress cannot be laid upon the importance of the sleeping-room being the largest, sunniest, and airiest room in the house ; for the greater part of one's life is spent in that room. Unfortunately, even among the wealthy classes, the best rooms are chosen for show rooms, and are sacrificed to the comfort of visitors ; whereas the rooms chosen as bedrooms (which are not seen by the visitor) are often the most miserable holes, lacking light and ventilation. But the penalty comes in the shape of doctor's and druggist's bills. The minimum quantity of air in the bedrooms of children under ten years of age should be 5 cubic metres ; for adults it must be twice as much. The soldier in the barracks is allowed 15 to 16 cubic metres of air space. Where servants are kept, these also should have decent, healthy sleeping-quarters. This is a matter of course, but one which, unfortunately, especially in large cities, is neglected both in regard to the construction of the houses and the disposition made of the rooms by the occupant.

Basement dwellings are often dark, and are damp and gloomy owing to insufficient ventilation. A basement built with substantial, independent walls, with a light-shaft reaching to the foundation, and having large, high windows, is less objectionable. Attics are hot in summer on account of their thin walls, and cold in winter. They cause greater mortality among young children than any other kind of living-place.

The walls of rooms may be covered with paper, or painted. In new buildings the walls should not be covered until at least one year after their erection. If covered sooner, the great quantities of moisture which enter the walls while the building is in construction cannot evaporate ; and the covering greatly retards the drying of the walls, which, in consequence, become damp and mouldy, and contaminate the air with their musty odour. Instead of being papered, the walls of a new building may be painted with water-colours, which do not interfere with the drying and which give the rooms an agreeable appearance.

Arsenic poisoning from wall-coverings was formerly not a rare occurrence, when these were manufactured with arsenic dyes. At present such a possibility exists only in rooms where a new covering has been pasted over an old one containing arsenic. It is advisable every two years to clean wall-papers with bread. This will show how much dust and dirt has accumulated on the paper.

The floors of houses should be smooth and have close seams. Broad seams favour the accumulation of dust, and allow the scrubbing-water to run between the ridges, where it may decompose and cause a disagreeable odour. The best flooring is one made of parquetry embedded in tar. Stone

floors are cold ; and like poor wooden floors they should be covered with linoleum, at least in the living-rooms and sleeping-rooms.

The cause of dampness is not always easily established, but if depending upon poor construction it can be remedied only by alterations in the structure of the building. In such a case it is best to consult an authority, and not follow the advice of interested business people who may advise some " unfailing " remedy. Dampness frequently results from some improper arrangement in a house. Rooms with thin walls will always be damp in winter if not sufficiently heated, for the moisture in the atmosphere of the room will condense on the cool walls. When a number of persons are together in a room, this dampness will be increased by the moisture which they throw off in breathing. Among the poorer classes, dampness in dwellings is often caused by allowing the doors connecting the living-rooms with the kitchen to remain open for the sake of utilising the heat from the range. The moisture from the cooking and washing pours from the kitchen into the adjoining rooms and condenses on the walls. During the first days of spring, ventilation should be undertaken very carefully, as the damp atmosphere of that season deposits moisture on the walls of poorly-heated rooms and makes them damp. Heating should, therefore, not be discontinued at the first approach of spring, but should be continued moderately, with an additional thorough ventilation.

Newly-constructed houses are always damp, even when they appear to be dry. The only advantage they possess is that they have not been lived in like old houses. For reasons of health, however, occupancy is advisable only after a certain degree of drying, and then only with careful heating and ventilation in the winter time. When heating new houses, the windows must be kept closed ; the air is renewed by repeatedly opening the windows and doors for a few minutes at a time. While ventilating the rooms a steady heat should be maintained, so that the incoming dampness may be carried off.

Every dwelling-place should have its own closet, which should be furnished with a window for light and air. If several households have one common closet, each family is apt to depend on the next one to keep it clean. Dark closets are not easy to keep clean, and those without windows contaminate the atmosphere of the houses. The most hygienic closets are those with running water. Where such cannot be introduced, earth closets are the next choice ; provided, of course, that earth is really strewn, a process which unfortunately is generally neglected after a time.

When the bathroom is furnished with a gas stove or geyser, this must be fitted with a pipe to carry off the gaseous products of combustion. The lack of such a waste-pipe has frequently caused poisoning (at times fatal) in consequence of the inhalation of the combustion products, even if in other respects the stove was properly cared for.

Even the smallest dwelling-place ought to have one cool closet for the preservation of articles of food. This is especially necessary in the summer time in order to keep boiled milk fresh for the children, as a decomposition of this article of food may have dangerous consequences. See CHOLERA INFANTUM.

The relation between dwelling and disease may exist in various ways. The harmful effect upon the health of the occupants of dwellings which lack air and light, and which are overcrowded and dirty, is so well known that it needs no further elaboration. Children especially suffer under such conditions. The same applies to dampness. Damp walls always cause a feeling of chilliness, because they condense moisture in the rooms and draw warmth from the occupants. This is most harmful when a person is sleeping, as the temperature of the body is then lowered; and it must be earnestly advised not to place beds close to damp walls. Catarrh and rheumatism are frequent results of living in damp houses, in which the air is generally poor on account of the rotting and mouldering processes constantly going on. In consequence, wooden furniture warps, dresses get mouldy, and articles of food decompose. The fungi which sometimes appear in damp houses add malodorous elements to the atmosphere, but do not contribute to the causes of disease. There is much hygienic nonsense, however, regarding dampness in dwellings, dampness often not being distinguished from lowered temperature.

If there have been dangerous contagious diseases in a house, the patient's room should be disinfected after the disease has run its course, so that the disease-germs will not remain and cause new infections. When moving into a new house it is important to ascertain whether the former occupants were healthy. If there were contagious diseases (consumption, for instance) the house should not be occupied before it has been thoroughly disinfected. It is best also to inquire about the possibility of contagious diseases among the neighbours, and if necessary to keep isolated from them; special attention should be given to the children, that they do not associate with children living in infected houses. See also the articles, BED; DISINFECTION; and LIGHT.

DYESTUFFS, POISONOUS.—Although the employment of dyestuffs, especially of those inimical to health, is regulated by law, cases of poisoning caused by them continue to occur. The poisonous dyestuffs most frequently used contain arsenic (green dyes), lead (white and black lead; Naples yellow), chrome (red and yellow), gamboge (yellow), and picric acid (in yellow dyes). Aniline dyes often contain arsenic. Poisonous dyestuffs are most frequently found in articles in common use; for instance, in dress-goods, furniture coverings, wall-paper, artificial flowers, candles, toys, and picture-books; rarely in cheap sweets. Only the three last objects may give rise to acute poisoning, which must at once be treated by antidotes. See ARSENIC-

POISONING; LEAD-POISONING. Dress-goods, wall-paper, and other articles containing poisonous dyes may cause chronic poisoning by inhalation of the dust or vapours arising in their manufacture. Such cases of poisoning usually manifest themselves by nausea, vomiting, diarrhœa, and severe headaches; or by external symptoms, such as skin-diseases, or inflammation of the eyes. See OCCUPATION DISEASES.

DYSENTERY.—An acute or chronic infectious disease, the seat of which is in the large intestine. It occurs in all climates, but most frequently and most severely in warm countries. In the temperate latitudes it occurs chiefly in summer and at the beginning of autumn; sometimes, especially in times of war, it occurs in the form of epidemics. The infectious principle is contained in the discharges from the bowels of the patients. Infection in most cases is brought about by the drinking of water which is contaminated by excremental substances. Owing to the general improvements made with regard to water-supplies, the frequency of the disease has greatly diminished during the last decades. Among the causes which directly give rise to the outbreak of dysentery are colds, and errors in diet, especially the eating of decayed food, unripe food, or of food not readily digestible. To these must be added certain bacteria. Three forms of the disease are to be distinguished: Catarrhal, gangrenous, and chronic dysentery.

Catarrhal dysentery begins generally as a simple diarrhœa. After one or several days, abdominal pains, located especially in the region of the navel, and painful but unsuccessful efforts to evacuate the bowels (*tenesmus*) occur. The stools assume the appearance which is characteristic of the disease, consisting either of small quantities (rarely more than a tablespoonful) of glassy mucus with bloody streaks, or of blood-coloured mucus. The discharges from the bowels become more and more frequent, and the abdominal pains as well as the tenesmus also increase in severity. The number of movements within twenty-four hours may be 20, 30, or more. If the disease progresses, the conditions of the stools usually changes after several days. They consist then of a yellowish or reddish fluid upon which float yellow, reddish or red particles which resemble chopped meat and are composed of blood and mucus. The appetite is lost. The strength of the patient diminishes considerably and rapidly. The disease, if treated correctly, lasts rarely more than a week. In some instances, however, it may be protracted for several weeks.

Gangrenous dysentery may begin as the catarrhal form, but in this affection the stools are changed into a brownish-red or blackish, smeary fluid of putrid odour, which contains smaller or larger gangrenous portions of the intestinal wall. The movements of the bowels are extremely frequent, 100 times and more in twenty-four hours, so that the patients are actually unable to leave the commode. Great weakness is present at the same time. Death is usually due to exhaustion.

GUIDE TO MANIKIN

I.—Blood-vessels; Respiratory and Urinary Apparatus

1. Trachea (windpipe)
2. Apex of right lung
3. Apex of left lung
4. Base of right lung
5. Base of left lung
6. Branches of the pulmonary artery
7. Branches of the pulmonary vein
8. Right ventricle of heart
9. Left ventricle of heart
10. Right auricle
11. Left auricle
12. Superior vena cava
13. Ascending aorta
14. Pulmonary artery
15. Inferior vena cava
16. Hepatic vein
17. Common iliac vein
18. Internal iliac vein
19. External iliac vein
20. Renal vein
21. Spermatic vein
22. Abdominal aorta
23. Inferior diaphragmatic artery
24. Superior mesenteric artery
25. Renal artery
26. Spermatic artery
27. Inferior mesenteric artery
28. Common iliac artery
29. Internal iliac artery
30. External iliac artery
31. Diaphragm
32. Right kidney
33. Left kidney
34. Right suprarenal capsule
35. Left suprarenal capsule
36. Right ureter
37. Left ureter
38. Bladder

II.—Muscular System (*From the front*)

1. Frontal muscle
2. Temporal muscle
3. Orbicularis palpebrarum (sphincter muscle of the orbit)
4. Zygomaticus minor (passing from the malar bone to the mouth)
5. Zygomaticus major (functionates as No. 4)
6. Buccinator or Trumpeter's muscle (used in blowing)
7. Sternoclidomastoid (bends the head forward)
8. Platysma myoides (superficial muscle of the neck)
9. Levator labii superioris (elevates the upper lip)
10. Levator labii superioris alæque nasi (functionates as No. 9, and also expands the nostril)
11. Orbicularis oris (ring-muscle of the mouth; draws the lips together, pouts them, and presses them against the teeth)
12. Depressor labii inferioris (depresses the lower lip)
13. Sternoclidomastoid (see No. 7)
14. Scaleni (oblique muscles of the neck, passing from the spine to the first and second ribs)
15. Trachea (windpipe)
16. Pectoralis minor (lesser muscle of the chest)
17. Intercostal muscles (covering the spaces between the ribs)
18. Pectoralis major (great muscle of the chest)
19. Serratus magnus (arises from the upper eight ribs and is inserted into the shoulder-blade)
20. Subclavius (passes from the shoulder-blade to the first rib)
21. External oblique muscle of abdomen
22. Rectus abdominis (straight muscle of abdomen)
23. Sheath of No. 22
24. Navel

Muscular System (*Continued*)

25. Internal oblique muscle of abdomen
26. Deltoid (elevator of the arm)
27. Biceps brachii (bends the arm)
28. Triceps (extends the forearm and renders its tissue tense)
29. Pronator radii teres (turns the hand and forearm, and assists in bending the forearm)
30. Supinator longus (turns the palm of the hand outward)
31. Flexor carpi radialis (bends the wrist and assists in turning the hand)
32. Palmaris longus (stretches the inner tissue of the palm)
33. Annular ligament of wrist
34. Extensor pollicis brevis (short extensor of thumb)
35. Flexor pollicis brevis (short flexor of thumb)
36. Flexor tendons of the fingers
37. Palmaris brevis (assists No. 32)
38. Coracobrachialis (raises the arm and draws it forward and inward)
39. Head of humerus
40. Long tendons of biceps
41. Deltoid (see No. 26)
42. Tendon of Pectoralis major (No. 18)
43. Short head of biceps
44. Long head of biceps
45. Triceps (see No. 28)
46. Flexor carpi radialis (see No. 31)
47. Long extensor of thumb
48. Extensor of index-finger
49. Extensor carpi radialis longior (extensor of wrist and forearm)
50. Extensor carpi radialis brevior (functionates as No. 49)
51. Pronator radii teres (see No. 29)
52. Poupart's ligament
53. Inguinal canal
54. Gluteus medius (abducts and rotates the thigh, and assists in keeping the body erect)
55. Pyramidalis (outward rotator of thigh and inward rotator of pelvis)
56. Pectineus (adducts the leg and assists in bending the thigh)
57. Adductor longus (long adductor of thigh)
58. Gracilis (abductor of thigh)
59. Vastus internus
60. Vastus externus
61. Tendon of Rectus femoris (The three last muscles are parts of the Quadriceps extensor cruris, the extensor of the knee, and the largest muscle in the body)
62. Patella (kneecap)
63. Gastrocnemius (the "calf" of the leg; bends the knee and extends the ankle-joint)
64. Flexor longus digitorum (long flexor of the toes)
65. Tendo Achillis (Achilles' tendon)
66. Long extensor of the great toe
67. Extensor longus digitorum (long extensor of the toes)
68. Tendons of extensor muscles of the toes
69. Crest of the ilium
70. Iliopsoas (flexor of the hip)
71. Tensor fasciæ latæ (tensor muscle of the fibrous tissue investing the muscles of the thigh)
72. Pectineus (see No. 56)
73. Adductor longus (see 57)
74. Vastus externus (see Nos. 60 and 61)
75. Rectus femoris (see No. 61)
76. Sartorius (tailor-muscle; functionates when one crosses the legs)
77. Vastus internus (see Nos. 59 and 61)
78. Peroneus longus and Peroneus brevis (strengthen the arch of the foot)
79. Tibialis anticus (flexor of the ankle)
80. Tibia
81. Extensor longus digitorum (see No. 67)
82. Extensor of great toe
83. Annular ligament of the ankle
84. Short extensor of the toes
85. Short extensor of the great toe
86. Gastrocnemius (see No. 63)
87. Soleus (assists in extending the foot)

III.—Skeleton (*From the front*)

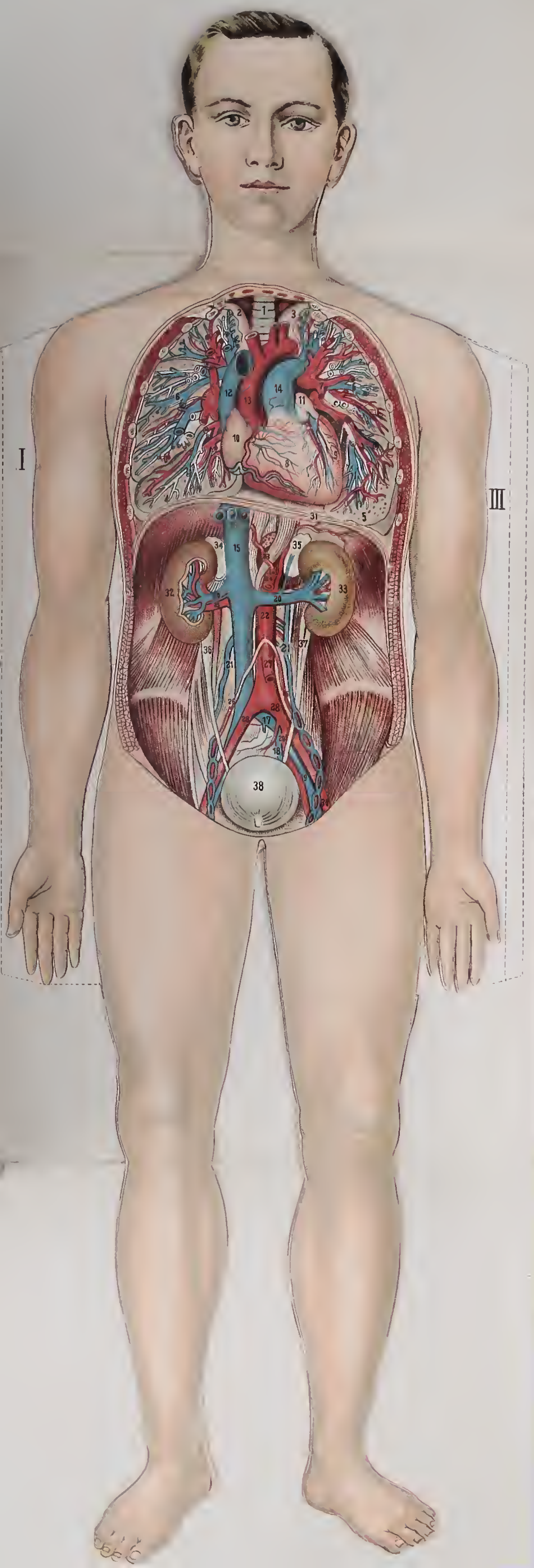
1. Frontal bone
2. Parietal bone
3. } Temporal bone
4. }
5. Zygomatic arch
6. Mastoid process
7. Nasal bone
8. Orbits
9. Superior maxillary bone (upper jaw)
10. Nasal fossæ
11. Teeth
12. Inferior maxillary bone (lower jaw)
13. Seventh cervical vertebra
14. First dorsal vertebra
15. Twelfth dorsal vertebra
16—20. Lumbar vertebræ
21. Sacrum
22. Coccyx
23. Manubrium of breast-bone
24. Body of breast-bone
25. Ensiform or xiphoid process of breast-bone
26. Clavicle (collar-bone)
27. Scapula (shoulder-blade)
28. Coracoid process
29—37. Ribs
38—40. False ribs
41. Costal cartilages
42. Iliac fossæ
43. Promontory of the sacrum
44. Crest of ilium
45. Pubis
46. Ischium
47. Foramen ovale
48. Body of humerus (upper arm)
49. Head of humerus
50. Trochlea
51. Elbow-joint
52. Ulna } bones of forearm
53. Radius }
54. Carpus (wrist)
55. Metacarpus (middle hand)
56. Fingers
57. Body of femur (thigh-bone)
58. Head of femur
59. Neck of femur
60. Greater trochanter of femur
61. Lesser trochanter of femur
62. Internal tuberosity of femur
63. External tuberosity of femur
64. Patella (kneecap)
65. Tibia } Bones of leg
66. Fibula }
67. Internal malleolus (tibia)
68. External malleolus (fibula)
69. Tarsus (ankle)
70. Metatarsus (middle foot)
71. Toes

IV.—Skeleton (*From the back*)

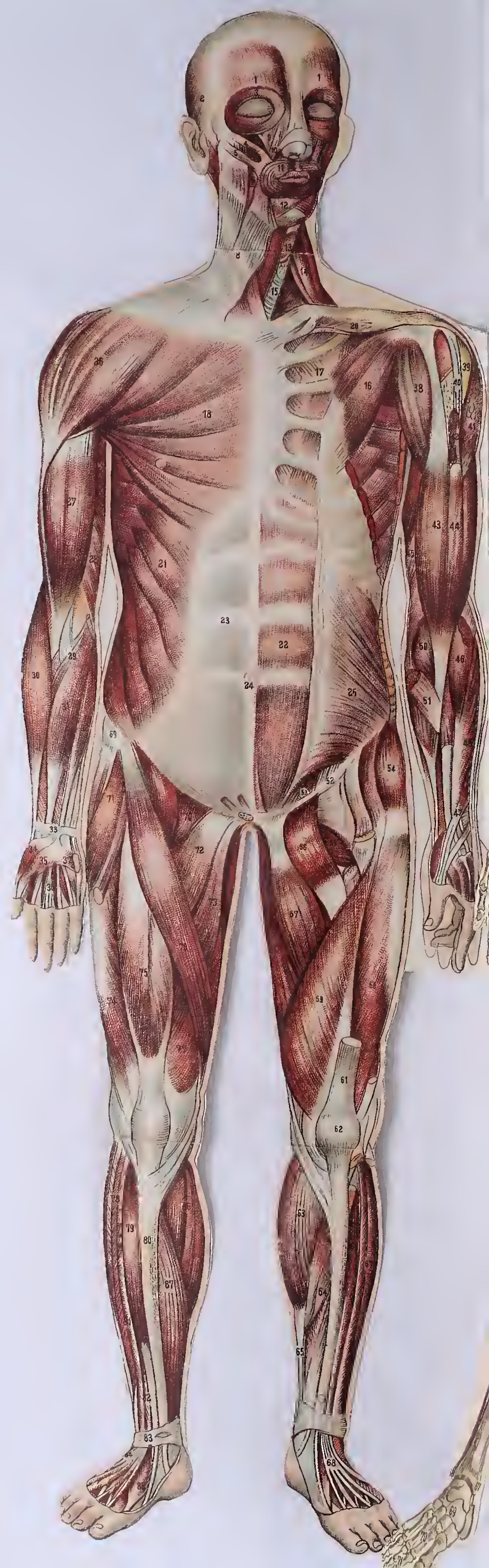
1. Occipital bone
2. Parietal bone
3. Temporal bone
4. Basilar process of occipital bone
5. Inferior maxillary bone (lower jaw)
6. Sagittal suture
7. Lambdoid suture
8. First cervical vertebra (atlas)
9. Second cervical vertebra (axis)
10—14. Cervical vertebræ
15. First dorsal vertebra
16. Twelfth dorsal vertebra
17. First lumbar vertebra
18. Fifth lumbar vertebra
19. Ribs
20. Scapula (shoulder-blade)
21. Spine of scapula
22. Clavicle (collar-bone)
23. Acromion
24. Body of humerus
25. Head of humerus
26. Ulna
27. Olecranon process
28. Radius
29. Bones of the wrist
30. Metacarpal bones
31. Fingers
32. Sacrum
33. Coccyx
34. Ilium } Forming the pelvis
35. Pubis }
36. Ischium }
37. Body of femur (thigh-bone)
38. Head of femur
39. Neck of femur
40. Greater trochanter
41. Lesser trochanter
42. External tuberosity
43. Internal tuberosity
44. Patellar surface
45. Fibula } Bones of lower leg
46. Tibia }
47. Calcaneum (heel)
48. Metatarsal bones
49. Toes

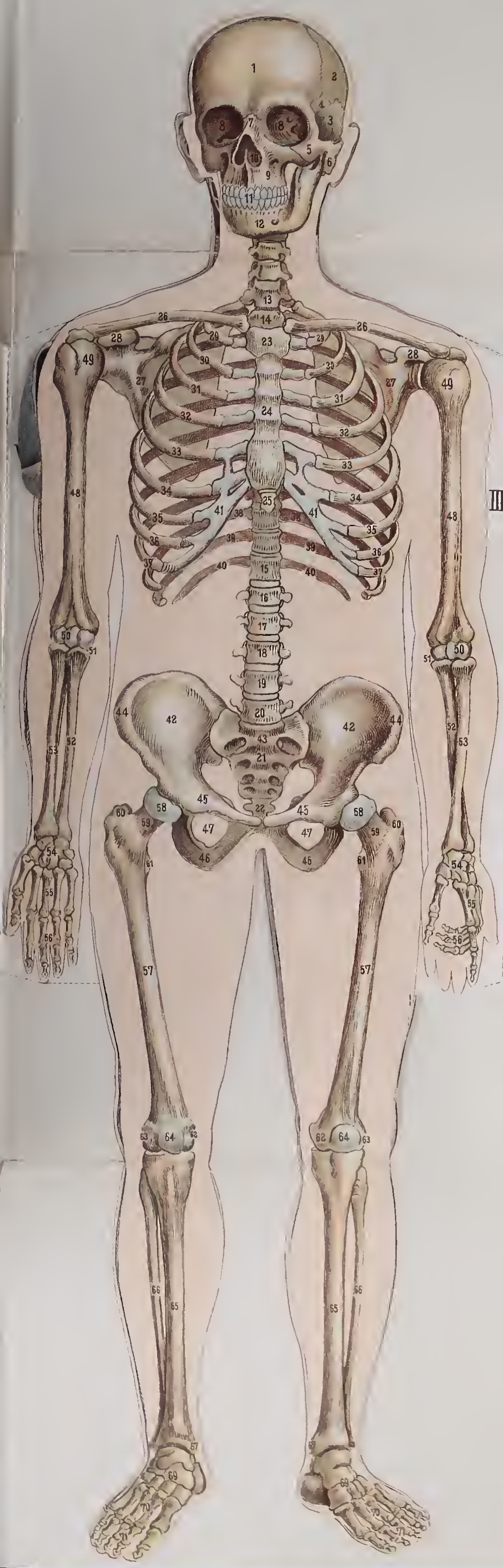
V.—Organs, Vessels and Nerves.

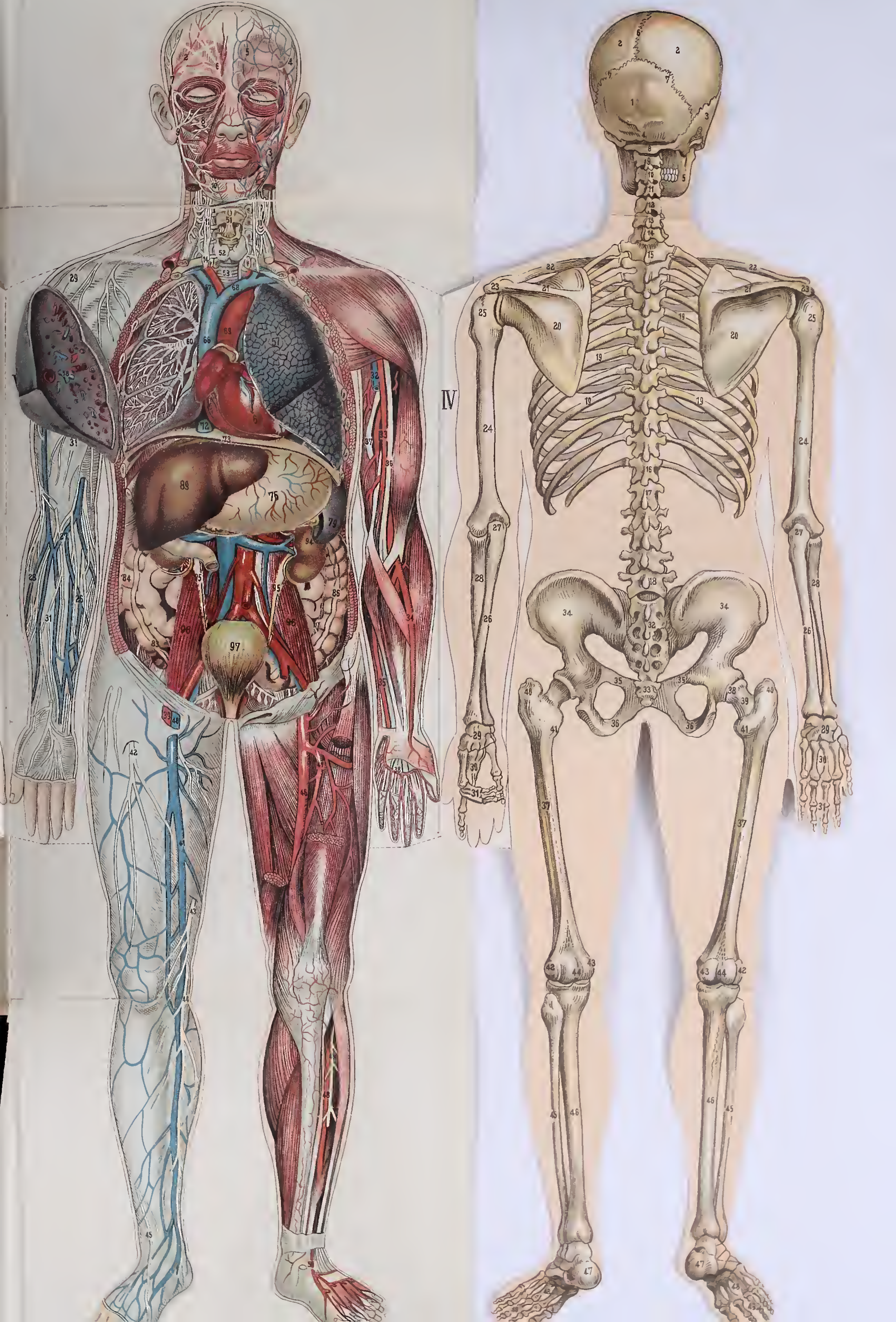
1. Facial artery
2. Superficial temporal artery
3. Facial veins
4. Temporal veins
5. Frontal veins
6. Frontal nerve
7. Temporal nerve
8.—10. Facial nerve and its branches
11. Cervical plexus
12. Spinal cord
13. Intercostal nerves
14. Ganglions of the sympathetic nerve
15. Twelfth dorsal nerve
16. First lumbar nerve
17. Fifth lumbar nerve
18. Lumbar plexus
19. Crural nerves
20.—21. Abdominal nerves
22. Cutaneous femoral nerve of the thigh
23. Sacral plexus
24. Intercostal arteries and veins
25—28. Superficial veins of the arm
29. Subcutaneous nerves of the shoulder
30. Cutaneous branch of the median nerve
31. Superficial nerves of the arm
32. Brachial vein
33. Brachial artery
34. Radial artery
35. Ulnar artery
36. Median nerve
37. Radial nerve
38. Superficial palmar arch
39. Femoral artery
40. Femoral vein
41. Internal saphenous vein
42—44. Cutaneous branches of the crural nerve
45. External popliteal nerve
46. Femoral artery
47. Deep femoral artery
48. Anterior tibial artery
49. Anterior tibial nerve
50. Dorsal digital arteries of the foot
51. Larynx
52. Thyroid gland
53. Trachea (windpipe)
54. Right bronchus
55. Left bronchus
56. Right lung (three lobes)
57. Left lung (two lobes)
58. Branches of the pulmonary artery
59. Branches of the pulmonary vein
60. Branches of the bronchi
61. Heart
62. Left ventricle (open)
63. Right ventricle (open)
64. Right auricle (open)
65. Left auricle (open)
66. Superior vena cava
67. Righ innominate vein
68. Left innominate vein
69. Aorta
70. Pulmonary artery
71. Pulmonary vein
72. Inferior vena cava
73. Diaphragm
74. Œsophagus (gullet)
75. Stomach
76. Internal surface of stomach
77. Cardiac orifice
78. Pylorus
79. Spleen
80. Pancreas
81. Duodenum
82. Small intestine (jejunum and ileum)
83. Cæcum and vermiform appendix
84.—88. Large intestine:
    - 84. Ascending colon
    - 85. Transverse colon
    - 86. Descending colon
    - 87. Sigmoid flexure
    - 88. Rectum
89. Liver
90. Cross-section of liver
91. Posterior aspect of liver
92. Gall-bladder
93. Right kidney (section shows ramifications of blood-vessels)
94. Left kidney (section shows internal structure: cortex, medulla, calix, pelvis)
95. Ureters
96. Iliopsoas muscle
97. Bladder
98. Urethral orifices
99. Internal aspect of bladder
100. Urethra



I
III
1
2
3
12
13
14
11
6
10
8
31
5
34
15
35
32
33
20
22
21
36
37
27
28
17
18
38




1
2
4
3
8
7
8
5
10
6
9
11
12
13
14
26
26
23
28
29
29
28
49
30
30
49
27
31
31
27
24
32
32
33
33
34
34
48
41
25
41
48
35
35
36
36
37
37
40
15
40
16
50
17
50
51
18
51
19
44
42
20
42
44
43
52
53
21
53
52
58
45
22
45
58
60
59
47
47
59
60
54
61
46
46
61
54
55
55
56
56
57
57
63
64
62
62
64
63
66
65
65
66
67
69
69
70
71


IV